

• Everything Is Made of Something •

Contains: Student Pages
Teacher Pages
National Science Standards Correlation
Background Sheets
Video and Reading Lists
Everything Copyable

.....
*Adaptable to your style, and
the abilities and learning
styles of your students.*

.....
*Activities suitable for
individual, group or full class
presentations.*

.....
*Using Science to learn
Geography, and Music to
learn History. Integrated
learning without stretching.*

.....
*Easy Remediation For
Kindergarten & First Grades,
and Special Needs Students.*

.....

Everything Comes From Our Natural Resources

A Study of the Earth

Let's appreciate the Earth and our place on it.

- **Where in the World Do Our Natural Resources Really Come From**
- **Is It Plant, Animal, or Mineral**
- **How Many Countries Does It Take to Make A Light Bulb**
- **Coloring Pages and Word Searches**
- **Legends and Lost Gold Mines**
- **Identifying Organics & Inorganics**
- **What Are Clothes Made Of**
- **If You Were King of the Land**
- **Discover The Resources That Made Your Classroom**

Download all for FREE at www.mii.org

© 2010, Mineral Information Institute

Teachers always have permission to reproduce these materials for use in their class.

www.mii.org

Table of Contents

Teacher Guide and Student Pages

Title	Page
Naturally Yours	7
Natural Resources Matter	9
Look Around: Everything is Made of Something	10
Colorado Home	13
Clothing Matters	15
People and Earth's Minerals	17
A Classroom Full of Resources	19
Your House Comes From a Mine	21
Mining Legends	23
Treasure Map	24
Legend of the Lost Dutchman	25
First Authenticated Gold Discovery in America	26
A World of Resources	27
Where Do Our Resources Come From?	28
Recycling Metals	29
How Do we Use Our Land?	31
Minerals Imported by the U.S.	36
The Earth – Nature's Storehouse	37
Geology and Natural Resource Development	39
Copper - The Ancient Metal	41
Maps	43
Did You Know?	46
Mineral Uses	47
"Top Secret"	51
Per Capita Mineral Usage	53

Materials Standards Compliance

A Study of the Earth

Grade Level: K-4

Natural Resources Matter

Type: Lessons & Activities

Science K-4.A (Science as Inquiry)

Science K-4.B (Physical Science)

Science K-4.D (Earth and Space)

Science K-4.F (Personal and Social)

Science K-4.G (History and Nature of Science)

Look Around: Everything is Made from Something

Type: Lessons, Activities & Poster

Science K-4.D (Earth and Space)

Science K-4.E (Science and Technology)

Science K-4.F (Personal and Social)

Science K-4.G (History and Nature of Science)

Clothing Matters

Type: Lessons & Activities

Science K-4.A (Science as Inquiry)

Science K-4.B (Physical Science)

Science K-4.D (Earth and Space)

Science K-4.E (Science and Technology)

Science K-4.F (Personal and Social)

People & Earth's Minerals

Type: Word Search Story

Science K-4.D (Earth and Space)

Science K-4.F (Personal and Social)

A Classroom Full of Resources

Type: Lesson & Activities

Science K-4.A (Science as Inquiry)

Science K-4.D (Earth and Space)

Science K-4.F (Personal and Social)

Your House Comes From A Mine

Type: Lesson and Activities

Science K-4.A (Science as Inquiry)

Science K-4.D (Earth and Space)

Science K-4.F (Personal and Social)

Mining Legends

Type: Lesson & Activities

Science K-4.A (Science as Inquiry)

Science K-4.G (History and Nature of Science)

A World of Resources

Type: Lesson & Activities

Science K-4.A (Science as Inquiry)

Science K-4.E (Science and Technology)

Science K-4.F (Personal and Social)

Science K-4.G (History and Nature of Science)

Recycling Metals

Type: Lesson & Activities

Science K-4.A (Science as Inquiry)

Science K-4.F (Personal and Social)

Science K-4.G (History and Nature of Science)

How Do We Use Our Land?

Type: Lesson & Activities

Science K-4.A (Science as Inquiry)

Science K-4.F (Personal and Social)

Science K-4.G (History and Nature of Science)

The Earth – Nature's Storehouse

Type: Lesson & Activities

Science K-4.A (Science as Inquiry)

Science K-4.D (Earth and Space)

Science K-4.E (Science and Technology)

Science K-4.F (Personal and Social)

Science K-4.G (History and Nature of Science)

Geology & Natural Resource Development

Type: Lesson & Activities

Science K-4.A (Science as Inquiry)

Science K-4.D (Earth and Space)

Science K-4.F (Personal and Social)

Science K-4.G (History and Nature of Science)

Mineral Uses

Type: Lesson & Activities

Science K-4.B (Physical Science)

Science K-4.D (Earth and Space)

Science K-4.E (Science and Technology)

Science K-4.G (History and Nature of Science)

Materials Standards Compliance

A Study of the Earth

Grade Level: 5-8

Natural Resources Matter

Type: Lessons & Activities

Science 5-8.A (Science as Inquiry)

Science 5-8.B (Physical Science)

Science 5-8.F (Personal and Social)

Science 5-8.G (History and Nature of Science)

Recycling Metals

Type: Lessons & Activities

Science 5-8.A (Science as Inquiry)

Science 5-8.E (Science and Technology)

Science 5-8.F (Personal and Social)

Science 5-8.G (History and Nature of Science)

Look Around . . . Everything is made from Something

Type: Lessons, Activities & Poster

Science 5-8.F (Personal and Social)

Science 5-8.G (History and Nature of Science)

How Do We Use Our Land

Type: Lessons & Activities

Science 5-8.A (Science as Inquiry)

Science 5-8.F (Personal and Social)

Science 5-8.G (History and Nature of Science)

Clothing Matters

Type: Lessons, Activities

Science 5-8.A (Science as Inquiry)

Science 5-8.E (Science and Technology)

Science 5-8.F (Personal and Social)

The Earth – Nature’s Storehouse

Type: Lessons & Activities

Science 5-8.A (Science as Inquiry)

Science 5-8.F (Personal and Social)

People & Earth’s Minerals

Type: Word Search Story

Science 5-8.D (Earth and Space)

Science 5-8.F (Personal and Social)

Geology & Natural Resource Development

Type: Lessons & Activities

Science 5-8.A (Science as Inquiry)

Science 5-8.F (Personal and Social)

Science 5-8.G (History and Nature of Science)

A Classroom Full of Resources

Type: Lessons & Activities

Science 5-8.A (Science as Inquiry)

Science 5-8.F (Personal & Social)

Copper – The Ancient Metal

Type: Lessons & Activities

Science 5-8.A (Science as Inquiry)

Science 5-8.F (Personal and Social)

Science 5-8.G (History and Nature of Science)

Your House Comes From a Mine

Type: Lessons & Activities

Science 5-8.A (Science as Inquiry)

Science 5-8.E (Science and Technology)

Science 5-8.F (Personal and Social)

Mineral Uses

Type: Lessons & Activities

Science 5-8.E (Science and Technology)

Science 5-8.F (Personal and Social)

Science 5-8.G (History and Nature of Science)

Mining Legends

Type: Lessons & Activities

Science 5-8.A (Science as Inquiry)

Science 5-8.F (Personal and Social)

Science 5-8.G (History and Nature of Science)

A Voyage To Mars

Type: Lessons & Activities

Science 5-8.A (Science as Inquiry)

Science 5-8.D (Earth and Space)

A World of Resources

Type: Lessons & Activities

Science 5-8.A (Science as Inquiry)

Science 5-8.E (Science and Technology)

Science 5-8.F (Personal and Social)

Materials Standards Compliance

A Study of the Earth

Grade Level: 9-12

A World of Resources

Type: Lessons & Activities

Science 9-12.A (Science as Inquiry)

Science 9-12.F (Personal and Social)

Science 9-12.G (History and Nature of Science)

Copper – The Ancient Metal

Type: Lessons & Activities

Science 9-12.A (Science as Inquiry)

Science 9-12.F (Personal and Social)

Science 9-12.G (History and Nature of Science)

Recycling Metals

Type: Lessons & Activities

Science 9-12.A (Science as Inquiry)

Science 9-12.F (Personal and Social)

Science 9-12.G (History and Nature of Science)

Mineral Uses

Type: Lessons & Activities

Science 9-12.F (Personal and Social)

Science 9-12.G (History and Nature of Science)

How Do We Use Our Land?

Type: Lessons & Activities

Science 9-12.A (Science as Inquiry)

Science 9-12.F (Personal and Social)

Science 9-12.G (History and Nature of Science)

A Voyage to Mars

Type: Lessons & Activities

Science 9-12.A (Science as Inquiry)

Science 9-12.D (Earth and Space)

The Earth – Nature’s Storehouse

Type: Lessons & Activities

Science 9-12.A (Science as Inquiry)

Science 9-12.F (Personal and Social)

Science 9-12.G (History and Nature of Science)

Geology & Natural Resource Development

Type: Lessons & Activities

Science 9-12.A (Science as Inquiry)

Science 9-12.F (Personal and Social)

Science 9-12.G (History and Nature of Science)

This is a detailed black and white line drawing by Bud Root, depicting a bustling Alaskan landscape. The scene is filled with various elements of Alaskan life and industry. In the foreground, a car is stuck in a mud trap, with a moose and a person nearby. A train travels through the middle ground, passing a small town and a river where people are fishing. The background features mountains, a smiling sun, and a large airplane flying overhead. The drawing is signed "Bud Root" in the bottom left corner.

6

NATURALLY YOURS

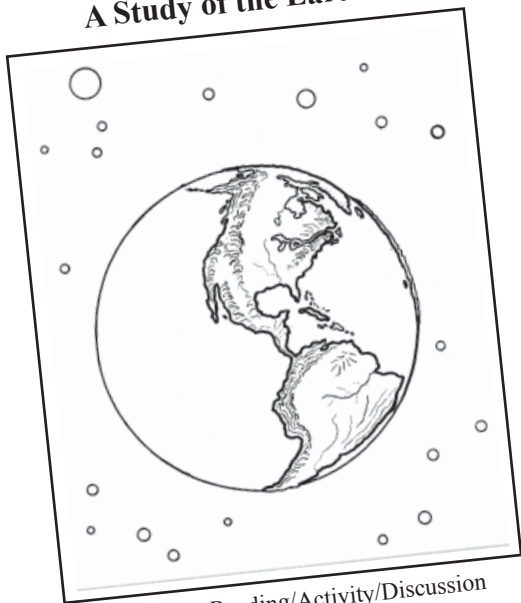
An Appreciation of the Earth and All It Provides

Most people live each day without thinking about the role natural resources plays in their lives. They know where to buy the things they want, but they seldom consider the origins of these items. They think food comes from a grocery store, electricity comes from a wall socket, clothes from a store, cars from a dealer, appliances from a department store... and so on. If we do think about how these things are

created, many of us probably imagine farms, factories and power stations. But without minerals and mining, we could not till our soil, build our machines, heat and cool our homes, transport our goods or maintain our society beyond the most primitive level.

Everything comes from something, and that "something" is our natural resources.

A Study of the Earth



Student Page: Reading/Activity/Discussion

"The vast loneliness we see up here is awe-inspiring, and it makes you realize just what you have back there on Earth. The Earth from here (the Apollo-8 spacecraft) is a grand oasis in the big vastness of space."

Astronaut James A. Lovell, Jr.

Exploring the Earth

Classroom Experience

- Using a globe, have the students identify which parts are solid, liquid, and gas.
- Have the students discuss where on Earth they are and where they have been on vacation.
- Demonstrate how day and night work by turning off the lights and using light from a window to illuminate the globe.
- More than 70% of the surface of the Earth is covered with water. Describe how snow and rain get to the rivers and eventually the ocean, and back again to land.

Elements Comprising the Earth's Crust

Oxygen	46.6%
Silicon	27.7%
Aluminum	8.1%
Iron	5.0%
Calcium	3.6%
Sodium	2.8%
Potassium	2.6%
Magnesium	2.1%
All Other	1.5%

Dig A Little Deeper

The demand for more resources comes with every breath you take. Try to find out how many minerals you use every day.

Is it possible for the Earth to run out of natural resources? Is it probable?

Why do we have more of some resources today than in the past?

AT HOME Discuss with families what would life be like if we didn't use natural resources. Discuss why we need to treat the Earth with respect and use our natural resources wisely.

**If You Can See It, Touch It, Taste It,
Smell It, Or Hear It,
It's A Natural Resource**

Visualization

If visualization is difficult for the students, try this:

Show a photograph of you or one of your students. Show a photograph of the entrance to your school that students are familiar with, stating that you (students) are inside the building. Show aerial photo of school (use Google Earth or MapQuest, satellite view), stating that this is how the school looks from up in the sky. Then show photo or sketch of Earth in Space, pointing out where your school (town) is located.



Everything we have and everything we use comes from our natural resources.
The Earth is the source for all of it. The air we breathe, the food we eat, the clothes we
wear, and the houses we live in all come from our natural resources.
We must use them wisely and treat them with respect.

NATURAL RESOURCES MATTER

Objective: To develop the concept that everything is made from a natural resource.

A Few Facts

Everything is either plant, animal or mineral. There is no exception. Each natural resource can be classified according to its state of matter – solid, liquid or gas. Each can also be divided into organic and inorganic matter.

Organic matter is (or once was) alive; it can live and die. Matter that can be *derived* from something that was alive is also organic, such as coal and some types of limestone. If something contains carbon, it is organic.

Inorganic matter, such as rocks, water and air, are not alive.

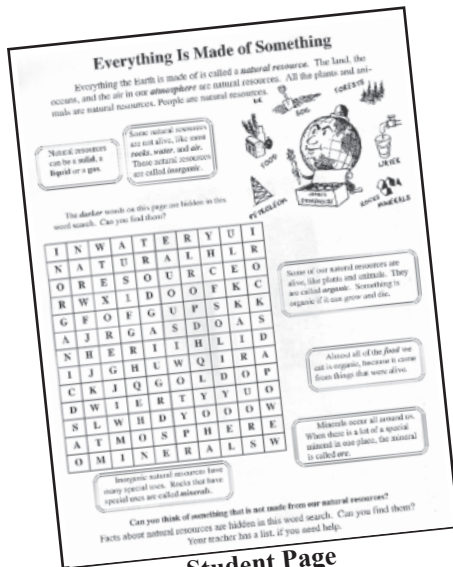
- Organic matter needs inorganic matter to live.
- Inorganics can exist without organics.

All jobs are related to natural resources – some more directly than others. All jobs are involved in upgrading (manufacturing) or using (service industry) natural resources. Only a few jobs are involved in actually developing the natural resources upon which everything else is dependent. They are:

Farmers, ranchers and fishermen: work to make the food we need from organic natural resources.

Timber workers: work in the forest to help us use the wood from the trees.

Miners and oil field workers: produce mineral resources from the ground to help us make things such as steel, glass, concrete, oil, plastics, electricity, etc.



Student Page

Read More About It!

Check out these books for your class:



- *Around the World in Eighty Days* by Jules Verne (many editions available)
- *The Magic Schoolbus Inside the Earth*, by Joanna Cole; Scholastic
- *From Seed to Plant* by Gail Gibbons; Holiday House

Video Deal Rock Odyssey, 30 minutes.

Possibly the best introduction to rocks and minerals for grades 2-6. Check www.mii.org to see how to purchase one.

Teachers are developing one of our greatest natural resources:

Our Children

Classroom Experience

In order to better understand the composition of the things around us:

Title a piece of paper "Natural Resources." Rule the paper into three wide columns, and label each column with one state of matter (solid, liquid, or gas).

Divide each column vertically again with a dotted line. Label the columns "organic" and "inorganic" or "grown" and "mined." Brainstorm with the students to list items to insert into the chart under the correct classification. Include everything in sight and even those things out of sight, such as air.

Absolutely everything that's mentioned can be categorized into at least one of these groups, with many fitting both groups.



Dig A Little Deeper

Is there anything that isn't made from a natural resource? Have groups of students challenge one another to research something that doesn't come from natural resources. (They won't find anything.)

Integrating the Curriculum

1. Explore the various ways to measure the three states of matter.
2. Prepare a list of rock formations that have become geographic symbols of countries or specific parts of countries, such as Gibraltar, Mt. Rushmore, etc.
3. "Colorado Home" was written by gold prospectors during the winter of 1884. Was it the original "Home on the Range"? Check the words (on page 13), the tune and the dates.

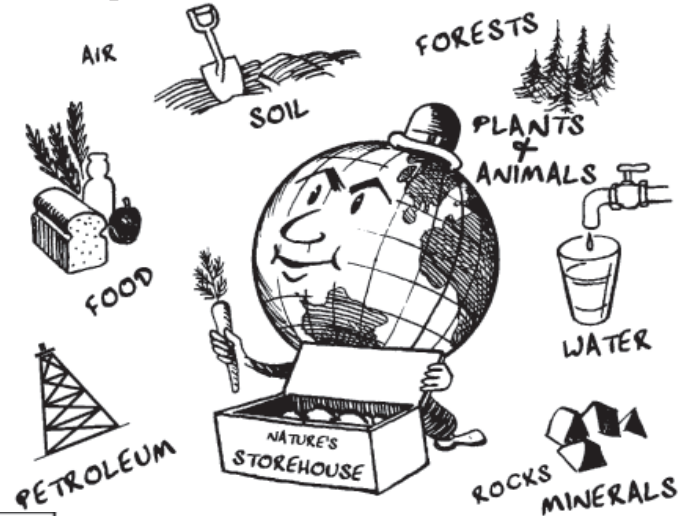
Everything Is Made of Something

Primary Word Search - Everything the Earth is made of is called a *natural resource*. The land, the oceans, and the air in our *atmosphere* are natural resources. All the plants and animals are natural resources. People are natural resources.

Natural resources can be a *solid*, a *liquid* or a *gas*.

Some natural resources are not alive, like most *rocks*, *water*, and *air*. These natural resources are called *inorganic*.

The *darker* words on this page are hidden in this word search. Can you find them?



I	N	W	A	T	E	R	Y	U	I
N	A	T	U	R	A	L	H	L	R
O	R	E	S	O	U	R	C	E	O
R	W	X	I	D	O	O	F	K	C
G	F	O	F	G	U	P	S	K	K
A	J	R	G	A	S	D	O	A	S
N	H	E	R	I	I	H	L	I	D
I	J	G	H	U	W	Q	I	R	A
C	K	J	Q	G	O	L	D	O	P
D	W	I	E	R	T	Y	Y	U	O
S	L	W	H	D	Y	O	O	O	W
A	T	M	O	S	P	H	E	R	E
O	M	I	N	E	R	A	L	S	W

Some of our natural resources are alive, like plants and animals. They are called *organic*. Something is organic if it can grow and die.

Almost all of the *food* we eat is organic, because it came from things that were alive.

Minerals occur all around us. When there is a lot of a special mineral in one place, the mineral is called *ore*.

Inorganic natural resources have many special uses. Most rocks that have special uses are called *minerals*.

Can you think of something that is not made from our natural resources?

Words about natural resources are hidden in this word search. Can you find them?

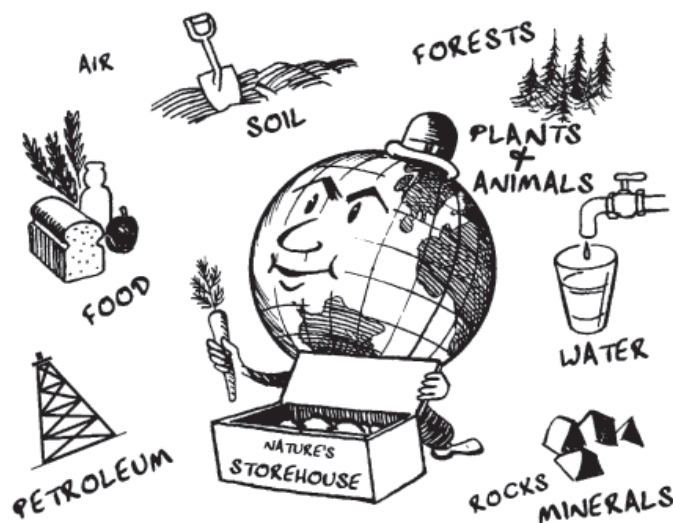
Your teacher has a list, if you need help.

Everything Is Made of Something

Secondary Word Search - Everything the Earth is made of is called a *natural resource*. The land, the oceans, and the air in our *atmosphere* are natural resources. All the plants and animals are natural resources. People are natural resources.

Natural resources can be a *solid*, a *liquid* or a *gas*.

Some natural resources are not alive, like most *rocks*, *water*, and *air*. These natural resources are called *inorganic*.



The *darker* words on this page are hidden in this word search. Can you find them?

A	I	R	S	T	O	R	E	H	O	U	S	E	E	R
S	N	A	T	U	R	A	L	H	H	O	F	P	L	M
D	O	N	T	W	O	R	R	E	S	O	U	R	C	E
F	R	C	I	M	R	M	E	E	R	O	E	A	A	N
S	G	H	O	E	O	E	U	D	W	R	L	L	H	E
F	A	R	M	T	L	S	D	E	K	E	W	I	I	R
G	N	N	P	A	L	I	P	G	L	F	O	O	D	G
H	I	S	D	L	U	R	P	H	S	O	D	S	T	Y
J	C	W	M	Q	G	O	L	D	E	P	R	W	D	L
J	L	C	I	E	R	C	N	B	U	R	I	T	O	P
K	A	L	N	W	F	K	G	W	A	T	E	R	E	K
F	O	R	E	S	T	S	Q	S	C	E	H	U	I	P
K	C	E	S	D	R	B	S	L	A	R	E	N	I	M
L	A	G	G	R	E	G	A	T	E	W	E	R	T	N
P	O	I	U	U	Y	T	G	R	A	V	E	L	R	E

Some of our natural resources are alive, like plants and animals. They are called *organic*. Something is organic if it can grow and die.

Almost all of the *food* we eat is organic, because it came from things that were alive.

Minerals occur all around us. When there is a lot of a special mineral in one place, the mineral is called *ore*.

Inorganic natural resources have many special uses. Rocks that have special uses are called *minerals*.

Can you think of something that is not made from our natural resources?

Other natural resources are hidden in this word search. Can you find them?

Your teacher has a list, if you need help.

Primary Word Search on Page 10

	1	2	3	4	5	6	7	8	9	10
a	I		W	A	T	E	R			
b	N	A	T	U	R	A	L			R
c	O	R	E	S	O	U	R	C	E	O
d	R				D	O	O	F		C
e	G		O					S		K
f	A		R	G	A	S	D	O	A	S
g	N		E			I		L	I	
h	I				U			I	R	
i	C			Q	G	O	L	D		
j			I							
k			L							
l	A	T	M	O	S	P	H	E	R	E
m		M	I	N	E	R	A	L	S	

Word— Beginning letter *l* diagonal word

Natural Resource— b1, c2

Minerals— m2

Liquid— k2, diagonal

Food—d8 (backward)

Atmosphere— l1

Inorganic— a1

Water— a3

Gas—f4

Organic— c1

Rocks— b10

Air— f9

Gold— i5

Ore— e3

Solid— e8

	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p
1	M		T	L	U	A	F	O	R	E	B	O	D	Y		E
2	O		I				T	U	N	G	S	T	E	N		A
3	U		T			O	R	E			Y	A	S	S	A	R
4	N		A	J	A	D	E						M			T
5	T	E	N				H			J		G	I			H
6	A	R	I	E		H	C	S	L	A	R	E	N	I	M	
7	I	O	U	L	F	A				S		M	I			
8	N	C	M	B	O	L	E	A	D	P		S	N			
9	S	L		R	R	I				E			G	L		
10		L		A	M	T		F		R	R	K	C	I	R	B
11	O	I	L	M		E	C	L	A	Y	E			M	E	
12		R	O	B	S	I	D	I	A	N	V	A	S	E	N	
13		D	P			T	I	N			L	G	C	S	I	
14	Q	U	A	R	T	Z	I	T	E		I	A	I	T	L	
15	V		L		U	I	E				S	T	E	O	C	D
16	A	H			R	N		K	P	V		E	N	N	I	U
17	L	S	Q	G	Q	C		A	A		O		C	E	T	N
18	L	A	U	N	U		R		D	U		L	E	L	N	E
19	E	T	A	I	O	T		L		M	Q		C		A	S
20	Y	O	R	G	I		O		H	U		H	G	A	S	
21	S	P	R	G	S	G		C		D			T		N	
22			Y	O	E		R							R		O
23				L	C	A	N	Y	O	N	S				A	
24	S	T	R	A	T	I	G	R	A	P	H	I	C			E

A little harder word search on Page 11

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
a	A	I	R	S	T	O	R	E	H	O	U	S	E		
b		N	A	T	U	R	A	L			F				
c		O	N	T	O		R	E	S	O	U	R	C	E	
d		R	C	M		M				O	E			N	
e	S	G	H		E	O		U			R	L	L	E	
f	F	A	R	M	T	S	D	E		E	I			R	
g		N	N		A	I	P		L	F	O	O	D	G	
h		I		D	L	U	R		H	O	S			Y	
i		C		M	Q	G	O	L	D	E	R				
j		L	I			C				R	T				
k		A	L	N		K		W	A	T	E	R	E		
l	F	O	R	E	S	T	S							P	
m		C						S	L	A	R	E	N	I	M
n		A	G	G	R	E	G	A	T	E					
o								G	R	A	V	E	L		

Word— Beginning letter

Natural Resource— b2, c8

Atmosphere— b3, diag.

Solid— c10, diag.

Liquid— k3, diag.

Minerals— m15, bkws.

Gas—o8, up

Rocks— h7

5 diagonal words

Inorganic— a2

Organic— c2

Food—g11

Ore— d11

Gold— i6

Water— k9

Air— a1

Fuel— b12

Energy— c15

Storehouse— a4

Sand— e1, diag.

Ranch— a3

Metal— d5

Gravel— o8

Mine— i4

Oil— g13, up

Soil— h13

Petroleum—L15, diag.

Oro— a6

Farm— f1

Forests— l1

Coal— m2

Aggregate— n2

People and Earth's Minerals

page 17-18 *5 diagonal words*

Agate, l-12

Anticline, o-19

Arch, f-23

Assay, o-3

Brick, p-10

Canyons, e-23

Chert, g-6

Clay, g-11

Drill Core, b-13

Dunes, p-15

Earth, p-1

Earthquake, p-24

Fault, g-1

Flint, h-10

Form, e-7

Gas, m-20

Gems, l-5

Gold, f-21

Halite, f-6

Jade, d-4

Jasper, j-5

Lead, f-8

Limestone, n-9

Logging, d-23

Marble, d-11

Minerals, o-6

Mining, m-4

Mountains, a-1

Mud, j-19

Obsidian, c-12

Oil, a-1

Opal, c-12

Ore, f-3

Orebody, h-1

Potash, b-21

Quarry, c-17

Quartzite, a-14

Science, m-12

Silver, k-15

Stratigraphic, a-24

Tin, f-13

Titanium, c-1

Tungsten, g-2

Turquoise, e-14

Trap, f-19

Valleys, a-15

Volcano, j-16

Zinc, f-14

Was *Home On The Range* really written by Colorado gold miners?

During the bleak winter of 1884-1885 in the boomtown of Leadville, Colorado, few diversions were at hand to occupy the evenings of those lonely prospectors who preferred to avoid the saloons, gambling halls, and scarlet ladies. But for Crawford O. "Bob" Swartz and his friends, there was music to make.

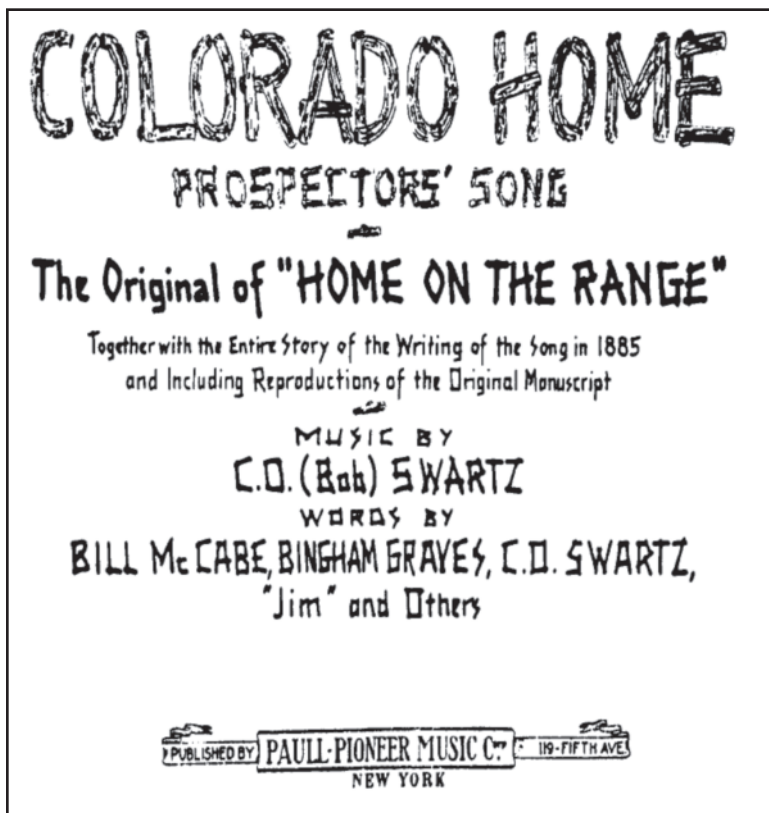
Bob and Bill McCabe and Bingham Graves and "Jim" (surname probably Fouts) had a fiddle, harmonica, and banjo band, and they would lounge about their shanty, which they called the "Junk Lane Hotel," and play and sing. "I can still see," Bob wistfully wrote years later, and these are his spellings, "the whole gang setting around on soap boxes & on the bed, all trying to make the lines rhyme so they sounded like poetry. Then when they got a verse so it sounded good, I would play the tune & Bill McCabe with the banjo & his nice tennor voice would lead in singing. I can see them all yet."

One of the tunes Bob and friends wrote was titled "Colorado Home," and the first verse began "Oh! Give me a home/ Where the buffalo roam/ And the deer and the antelope play."

Bob jotted the words in the musical notebook he always carried, and in a letter to his parents dated February 15, 1885, he described the writing of the song: "We have originated a new song, music and all, & it's creating quite a stir among the boys all around. I got up the tune and Bill most of the words, but we all had a hand in it. As the cabin was full that night & every body help make it up, if it keeps on going it will become a popular western song."

Soon the Junk Lane Gang broke up and scattered in all directions, Swartz returning to his home in Pennsylvania.

Many years passed, and radio was invented, and from these electronic loudspeakers wafted a hit song titled "Home on the Range." Imagine the surprise of Swartz to hear "his" song on the radio—even though some of the verses were different: What, for instance, had been:



*Oh, give me a hill
And the ring of the drill,
In the rich silver ore in the ground. . . .*
was now:

*How often at night,
When the heavens are bright
With the light of the glittering stars. . . .*

Swartz died on March 12, 1932, convinced that his, and not the other, was the original of "Home on the Range." Concerned that her brother may have written an American classic for which he received neither recognition nor recompense, Swartz's sister, Laura M. Anderson of Parkland, Pennsylvania, wrote to the Paull-Pioneer Music Corporation, publisher of "Home on the Range," inquiring of the song's origin. She included a copy of the 1885 letter written by her brother, citing the lyrics to "Colorado Home."

Kenneth S. Clark of the Paull organization, who had supervised Paull's publishing of "Home on the Range," responded:

[Writing of "Colorado Home"] was as close to general public recognition as Mr. Swartz came during his lifetime, for he died . . . without having received

credit before the world for the part played by himself and his comrades in the creating of what is now the favorite song of many Americans, including President Franklin D. Roosevelt. The story may therefore make us reflect meditatively that there must have been many other anonymous authors of our songs of the Far West who passed to the Great Round-Up, as did Mr. Swartz, without receiving the least public recognition of their contributions to our folk literature.

To assuage whatever wrongs may have been perpetrated against Bob Swartz and his friends, Paull-Pioneer in 1933 published sheet music of "Colorado Home," with lyrics as written in Leadville. The sheet also included the original jottings from Bob's notebook, a copy of the letter to his parents, an affidavit from his sister, a photo of Swartz and of Leadville including the

Junk Lane Hotel, and, most importantly, the assertion in bold print that "Colorado Home" was: "The Original of 'Home on the Range' Together with the Entire Story of the Writing of the Song in 1885." Added was a sympathetic explanation of the whole affair by Mr. Clark of the Paull organization:

[The] spread of the song in the Far West was typical of what are commonly known as folk songs—songs of no known authorship which have become songs of the people. . . . It is probable that the [Junk Lane crowd] performed it for their friends and associates, and thus it came to be generally sung without anyone's knowing who had written it. That is the case with many of most folk songs. . .

Thus it was recognized by the publisher of "Home on the Range" that the Junk Lane musicians were essentially the song's composers.

COLORADO HOME

Oh, give me a home where the buffalo roam,
And the deer and the antelope play;
Where seldom is heard a discouraging word,
And the sky is not cloudy all day.

Oh, give me the hill and the ring of the drill,
In the rich silver ore in the ground;
And give me the gulch, where the miners can sluice,
And the bright yellow gold can be found.

Oh give me the gleam of the swift mountain stream,
And the place where no hurricanes blow;
And give me the park with the prairie dog bark,
And the mountains all covered with snow.

PROSPECTORS' SONG The Origin of "Home on the Range"

Oh, give me the mines where the prospector finds,
The gold in its own native land;
With the hot springs below, where the sick people go,
And camp on the banks of the Grand.

Oh, show me the camp where the prospectors tramp,
And business is always alive;
Where dance halls come first and fare banks burst,
And every saloon is a dive.

Chorus

A home, a home, Where the deer and the antelope play;
Where seldom is heard a discouraging word,
And the sky is not cloudy all day.

And there the matter rested until 1935, when New York attorney Samuel Moanfeldt was retained to investigate the origins of "Home on the Range" in conjunction with a \$500,000 copyright infringement lawsuit brought by William and Mary Goodwin of Tempe, Arizona. They contended that their "An Arizona Home" was the parent song of "Home on the Range."

Moanfeldt performed a thorough investigation which took him to several states and cities, including Leadville and other Colorado points, interviewing survivors and acquaintances of Swartz, Graves, Fouts, and McCabe. Moanfeldt's conclusions were (a) that the Goodwins had no case; (b) that the growing number of persons asserting authorship of "Home on the Range" was remarkable; (c) that the original song was probably much older than 1885 when Swartz claimed to have written it; (d) that the Junk Lane Hotel boys may indeed

have written five stanzas not in the original but instead which suited their own prospecting circumstances and their Colorado environment.

Moanfeldt and subsequent sources ascribe "Home on the Range" not to Leadville, Colorado, but instead to Smith Center, Kansas (indeed, in 1947 it became the Kansas state song). The melody is thought to have been written by carpenter and musician Daniel E. Kelly, and the words by itinerant alcoholic physician Brewster M. Higley, and first published in a December 1873 issue of the *Smith County Pioneer* under the title "Oh, Give Me a Home Where the Buffalo Roam."

Source: From an article in Colorado Heritage, Spring 1992, p. 14-16, Colorado Historical Society. Colorado Sheet Music by Terry Shockey- excerpt by Clark Secrest.

CLOTHING MATTERS

Objective: To discover the natural resources that create our clothing.

A Few Facts

Clothes of the distant past were made from organic (living) materials. Almost all synthetic fabrics and materials used today are made from petroleum or natural gas.

Tennis shoes are a great example: Some of the rubber is natural (latex from trees), but most tennis shoe rubber is synthetic. Shoelaces can be both natural and man-made materials. The uppers can be of leather, canvas, vinyls or other man-made materials.

Almost all modern buttons are made of plastic. Thread and labels are generally cotton, polyester or blends of the two.

Recent years have seen a renewal of interest in clothing made of natural fibers, but those fibers are fertilized and grown, processed, sewn, packaged, and transported by processes and machines made of minerals and metals.

Classroom Experience

Research the origins of the following clothing fibers:

Cotton, silk, rayon, nylon, polyester or acrylic fibers, ramie and wool.

How are these different materials colored and made into clothing?

Discover what your clothes are made of.

Ask each student to choose a partner, and taking turns, read the labels in one another's clothing. Students can then make a chart listing the different fibers they are wearing and the sources of those fibers.

Discuss the purpose of clothing labels.

- Which materials are man-made and which are natural?
- What properties of fiber make it attractive for clothing use?
- Analyze the "content" and "care" information. Determine the characteristics of different clothing materials. Why can some be washed in hot water, others only in cold? Why can't some be put in a clothes dryer or ironed? What about bleach?

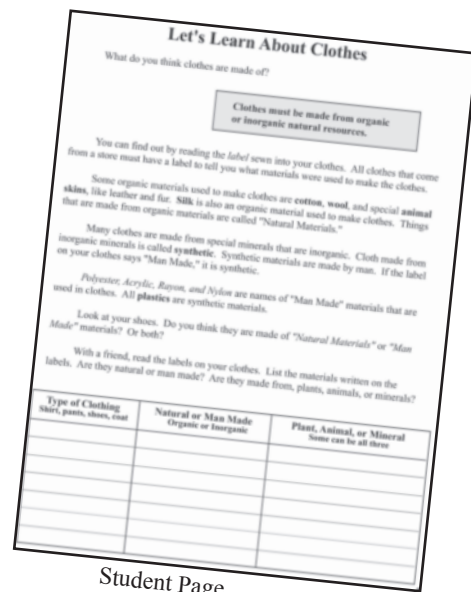
Dig A Little Deeper



- Make life-size replicas of the clothing worn at different times in the history of the country; Pilgrims and Indians, the Civil War, World War II; and label each piece of clothing and the origin of its fiber.
- Write an advertisement for a new line of clothing using only man-made (synthetic) materials.
- Levi's were "invented" for miners during the California Gold Rush. What other special clothes were necessary if you lived 100 years ago?

Integrating the Curriculum

1. How much does a wool sweater weigh? In about the same style and size, how much does an acrylic sweater weigh? Do they use the same amount of space when folded?
2. What is the process that makes raincoats waterproof and how does it work?
3. Have students search their homes for other labels such as these: nutrition and health – cereal boxes and vitamins; safety – electric hair dryer; operating instructions – appliances.



Read More About It!

- Check out these children's books for your class:
- *Cotton* by Millicent Selsam; Morrow Junior Books
 - *The Keeping Quilt* by Patricia Polacco; Simon & Schuster
 - *The Rag Coat* by Lauren Mills; Little Brown
 - *18th Century Clothing* and *19th Century Clothing* by Bobbie Kalman; Crabtree Publishing
 - *Cotton in Your T-Shirt* by Aline Riquier; Young Discovery Library

Let's Learn About Clothes

What do you think clothes are made of?

Clothes must be made from organic or inorganic resources.

You can find out by reading the *label* sewn into your clothes. All clothes that come from a store must have a label to tell you what materials were used to make them.

Some organic materials used to make clothes are **cotton**, **wool**, and special **animal skins**, like leather and fur. **Silk** is also an organic material used to make clothes. Things that are made from organic materials are called "Natural Materials."

Many clothes are made from special minerals that are inorganic. Cloth made from inorganic minerals is called **synthetic**. Synthetic materials are made by man. If the label on your clothes says "Man Made," it is synthetic.

Polyester, Acrylic, Rayon, and Nylon are names of "Man Made" materials that are used in clothes. So are Kevlar, Spandex, and Gor-Tex. All **plastics** are synthetic materials.

Look at your shoes. Do you think they are made of "*Natural Materials*" or "*Man Made*" materials? Or both?

With a friend, read the labels on your clothes. List the materials written on the labels. Are they natural or man made? Are they made from plants, animals, or minerals?

Type of Clothing Shirt, pants, shoes, coat	Natural or Man Made Organic or Inorganic	Plant, Animal, or Mineral Some can be all three

PEOPLE AND EARTH'S MINERALS

Word Search Story

Ancient people used **minerals** that came from the Earth. They used **chert**, **flint**, **jasper**, **obsidian** and **quartzite** for tools and weapons which they shaped by using deer antlers (which are shed every year) or other hard-pointed sticks or rocks.

Ancient people used **clay** to make pots for cooking and jars to hold water or store food. Some minerals and **gems**, such as **agate**, **jade**, **opal**, and **turquoise**, were prized possessions and were often used for trading and bartering.

Ancient people learned how to mix soil and water to make **mud**. Straw and grass were added to the mud to make it stronger. This mixture was then formed into brick-like shapes and dried. The bricks, called adobe, could be stacked and stuck together with more mud. Today, bricks are made of clay.

Even ancient people experienced the violent actions of **earthquakes** or **volcanoes** that change Earth's **form**. The land we live on has many forms and is always changing. In some places there are **mountains**. In other places there are **canyons** and **valleys**. Each type of land form has a name. In the San Luis Valley of Colorado you will find sand **dunes**. The wind action keeps the dunes in one area but their shapes are constantly changing. In Utah there is a land form called Arches National Monument. The wind, rain, and snow have actually worn huge holes all the way through **limestone** outcrops. Forms that look like rock bridges are called **arches**. There are many odd shapes formed by the erosion of wind and water. Some even look like people.

Modern people have an easier way of life than the ancient people because of advances in **science** and technology. All of the products we use today also come from the Earth. The raw materials used to make the products we need have to be mined.

Mining for minerals is done in many ways. Some minerals are found near the surface of the Earth. They can be mined by the open pit or strip mining method. Minerals that are hidden deep in the Earth are extracted by digging a deep shaft straight down. Horizontal drifts are mined off certain levels of the shaft. All mining depends on where economic concentration of minerals (**ore**) are found.

When economic amounts of a mineral are found it is called an **orebody**. As an example, **halite** (salt) is found in almost pure form in the state of Kansas. Halite is usually mined underground by the room-and-pillar mining method. This method is also used to mine trona and **potash**. Potash is used as a fertilizer. **Marble** (the metamorphic form of limestone) is mined by the **quarry** method. It is taken out of the ground in big blocks and is used for buildings, flooring, and for art works such as statues.

An orebody may contain a combination of metals such as **tin**, **titanium**, **lead**, **zinc**, **tungsten**, **gold**, and **silver**. When more than one mineral is found in an ore body a scientist (metallurgist) has to decide which processes will be needed to recover each mineral. Processing several metals/minerals can be expensive.

To determine the size and value of an ore body, geologists drill holes in the Earth. The drill they use is called a core drill. The entire core is brought to the surface where the geologist inspects its mineral content. Geologists call this core "**drill core**." The **logging** (recording) of the drill core is very important. The geologist records the depth at which the core was taken and the amount of mineral present. **Assays** by a chemist are made to determine the quantity and quality of the mineral or metals present. Sometimes many holes have to be drilled to show the outline of the ore body. After the drilling data is plotted on a map the geologist can determine whether the ore body is large enough to mine at a profit.

Oil and **gas** are also mined, but in a different way than metals and minerals. Holes (called wells) are drilled into the ground until they hit rocks containing economic amounts of oil or gas. Oil and gas fill the tiny spaces between the grains of porous rocks, usually sandstone. Oil and gas move upward in these porous rocks until they are stopped (trapped) by nonporous rocks, usually a shale called caprock. There are three types of **traps**. An upward bulge of rock layers is called an **anticline** trap. Where caprock is moved by faulting on top of oil and gas-bearing beds, the trap is called a **fault** trap. The hardest place to find oil is in a **stratigraphic** trap. A stratigraphic trap is where a body of sandstone (like a sandbar or river channel) is enclosed by nonporous rock.

There are 48 words in bold-face. These words can be found in the Word Search puzzle on the next page.

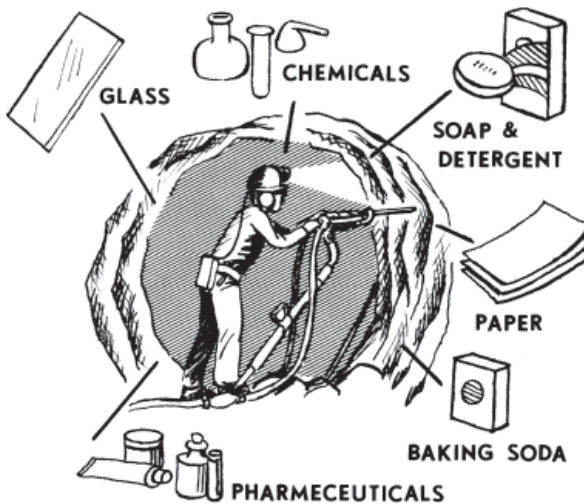
Formations containing oil and gas, coal, as well as minerals and metals may lie under mountains, deserts, marshes, or seas. They may be two or three miles below the surface. Some are deeper.

Natural resources are a gift to Earth's people. We should use and conserve them wisely. The quest for a better life-style has brought untold benefits to the human beings who inhabit our Earth—none of which would exist but for the ingenuity and thought processes of the human mind.

To investigate more about our Earth and its natural resources, just for fun—try your school or local library . . . which book will you use for starters?

The bold-face words used in the lesson you have read are shown to the right. Have fun finding them in the word search below!

(Note: there are only 5 diagonal words.)



TRONA MINING and USES

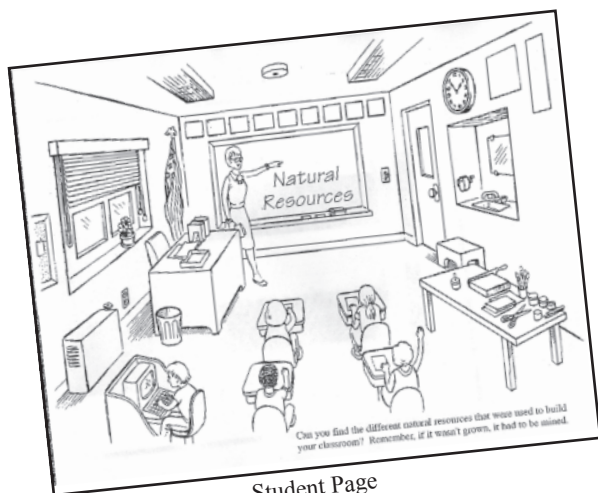
The world's largest deposit of trona is found in Wyoming's Green River Basin, located in the southwestern part of the state. This deposit produces about 95% of the United States' supply of natural soda ash.

Agate
Anticline
Arch
Assay
Brick
Canyons
Chert
Clay
Drill Core
Dunes
Earth
Earthquake
Fault
Flint
Form
Gas
Gems
Gold
Halite
Jade
Jasper
Lead
Limestone
Logging
Marble
Minerals
Mining
Mountains
Mud
Obsidian
Oil
Opal
Ore
Orebody
Potash
Quarry
Quartzite
Science
Silver
Stratigraphic
Tin
Titanium
Tungsten
Turquoise
Trap
Valleys
Volcano
Zinc

M	Q	T	L	U	A	F	O	R	E	B	O	D	Y	T	E
O	Y	I	U	G	K	T	U	N	G	S	T	E	N	R	A
U	T	T	G	R	O	R	E	G	O	Y	A	S	S	A	R
N	X	A	J	A	D	E	R	H	T	U	O	M	T	O	T
T	E	N	Y	U	N	H	E	A	J	H	G	I	X	Y	H
A	R	I	E	L	H	C	S	L	A	R	E	N	I	M	B
I	O	U	L	F	A	T	H	E	S	I	M	I	N	A	G
N	C	M	B	O	L	E	A	D	P	E	S	N	T	A	C
S	L	U	R	R	I	O	T	P	E	H	E	G	L	B	E
P	L	E	A	M	T	X	F	W	R	R	K	C	I	R	B
O	I	L	M	X	E	C	L	A	Y	E	L	A	M	E	R
R	R	O	B	S	I	D	I	A	N	V	A	S	E	N	U
K	D	P	E	I	T	I	N	L	O	L	G	C	S	I	O
Q	U	A	R	T	Z	I	T	E	T	I	A	I	T	L	Y
V	O	L	Q	U	I	E	H	A	E	S	T	E	O	C	D
A	H	I	U	R	N	X	K	P	V	M	E	N	N	I	U
L	S	Q	G	Q	C	L	A	A	L	O	G	C	E	T	N
L	A	U	N	U	K	R	T	D	U	X	L	E	L	N	E
E	T	A	I	O	T	W	L	P	M	Q	E	C	K	A	S
Y	O	R	G	I	K	O	J	H	U	U	H	G	A	S	D
S	P	R	G	S	G	W	C	N	D	A	W	T	L	N	Y
T	I	Y	O	E	X	R	Y	E	M	K	J	E	R	E	O
E	V	O	L	C	A	N	Y	O	N	S	Y	T	I	A	B
S	T	R	A	T	I	G	R	A	P	H	I	C	G	N	E

A CLASSROOM FULL OF RESOURCES

Objective: To reinforce the concept that natural resources are all around us.



A Few Facts

Natural resources are substances we obtain from the land, water, and air around us.

Our food, shelter and amenities of life – cars, bicycles, tents, baseballs and bats – all are made from our natural resources.

Look around the room you are in. The odds are very high that the majority of what you see is made from mineral products. In schools, unless it is a hardwood floor, it will be made of various rocks and minerals. Walls will almost always be brick or concrete block, sometimes drywall (gypsum) or wallpaper (almost always a vinyl). Wood is usually a major part of most desks and tables, and doors. There can be a lot of variety in the ceiling materials, but rest assured they were either grown or mined.

If your students seem reluctant, see "Your House Comes From A Mine" on page 21.

Read More About It!

Check out these children's books for your class:

- *Prairie Visions: The Life and Times of Solomon Butcher* by Pam Conrad; Harper-Trophy
- *What's the Big Idea, Ben Franklin?* by Jean Fritz; Putnam Publishing Group
- *If You Sailed on the Mayflower in 1620* by Ann McGovern; Scholastic
- *The Erie Canal* by Peter Spier; Doubleday
- *The Evolution of Useful Things* by Henry Petroski; First Vintage Books

Classroom Experience

Label as many resources as possible that are found in the classroom.

Divide students into several teams. Assign an area of the classroom (or wherever you choose) to each team and provide each group with peel-off removable sticky labels.

Ask the students to label all of the natural resources in their designated areas and to list each item they label. They can then cooperatively sort the list into common components, such as wood, metals (steel or aluminum), minerals (brick or concrete blocks), or synthetics.

Suggest they do the same at home and discuss the different materials in each student's home – tile vs. linoleum, brick vs. wood, carpet vs. wood floors, metal vs. wooden window and door frames, etc.

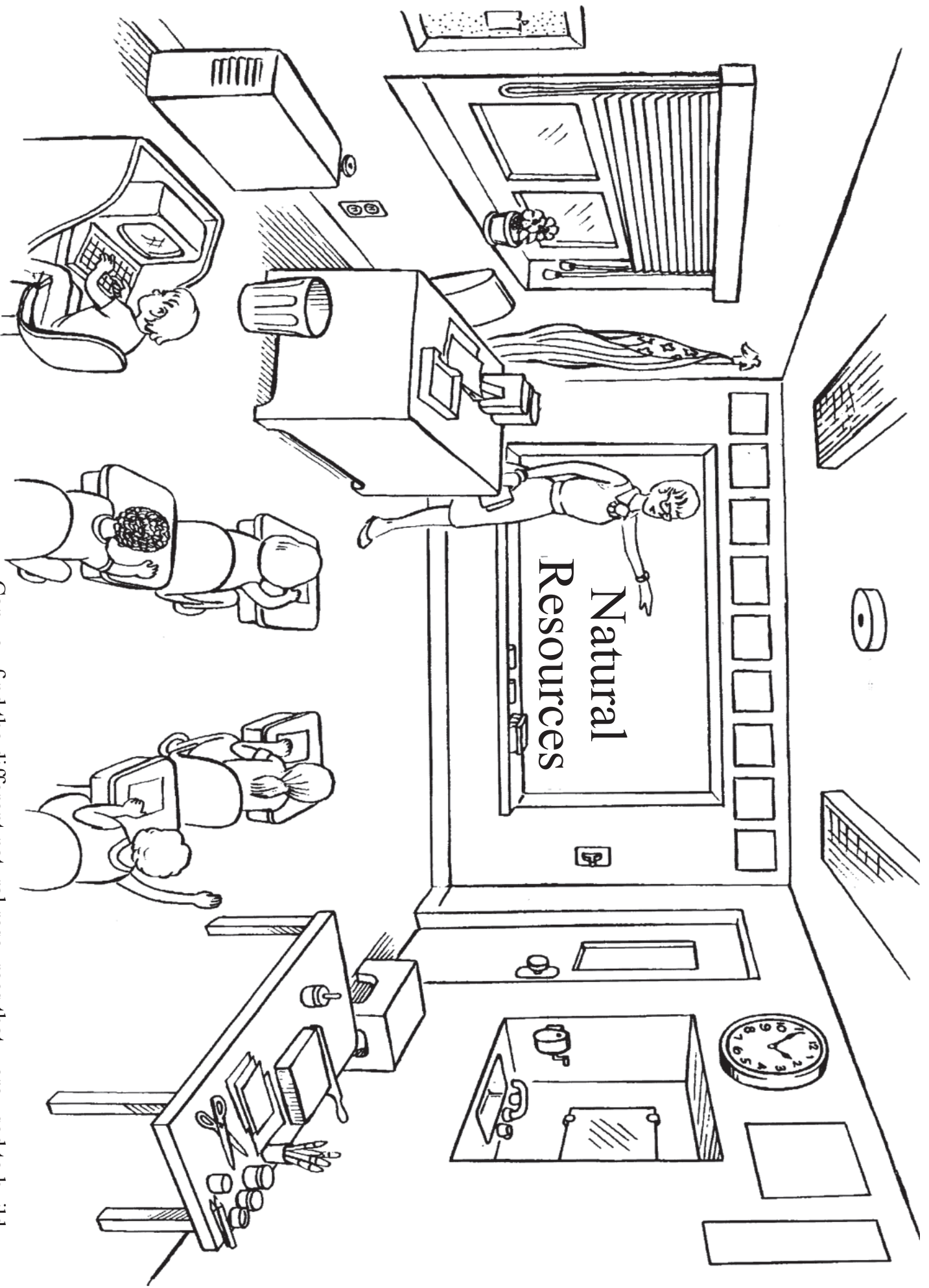
Integrating the Curriculum

1. Where does electricity come from? How do we harness it?
2. What is a board foot of lumber? Suggest that the students interview a few local builders or carpenters and report back to the class on the skills these professionals feel they need.
3. What effect do the various climactic changes have on construction of houses and buildings in any one area. How are buildings made "earthquake-proof?"
4. Why do we paint our houses? What do we use?
5. What are computers made of? Computers make a great themed study from manufacture, to programming, to use in schools, businesses and the home.



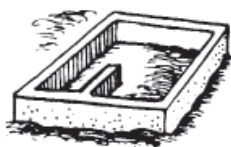
Dig A Little Deeper

- Draw the cafeteria and label its natural resources.
- Find out what minerals used in your classroom are mined in your community, state or nation.
- Study a bicycle. How many different materials are needed to make it? Why is it important to use a strong material in the frame?



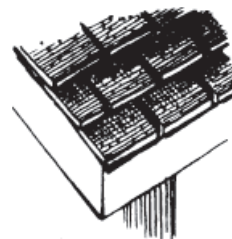
Can you find the different natural resources that were used to build your classroom? Remember, if it wasn't grown, it had to be mined.

Your House Comes From A Mine



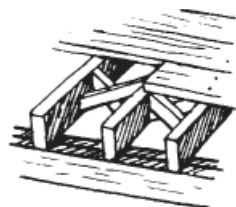
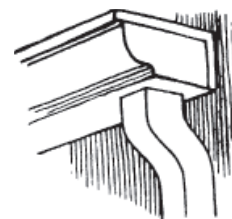
The **foundation** and **sidewalk** are probably concrete (*limestone, clay, shale, gypsum and aggregate*) and the **driveway** is made of concrete or asphalt (*petroleum and aggregates*).

The **roof** may be covered with asphalt shingles (*petroleum and a variety of colored sands*), fiberglass (*silica sand*), clay, or corrugated *iron*.



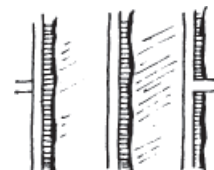
The **exterior walls** may be of concrete block, brick (*clay*), stone or aluminum siding, all provided by mining.

The **gutters** can be made of galvanized steel (*iron and zinc*), aluminum (*bauxite*), or plastic (*petroleum*).



The **lumber** in the **walls, roof and floor** will be fastened together with nails and screws (*iron ore and zinc*).

The **insulation** in the walls may be glass wool (*silica, feldspar, trona*) or expanded vermiculite.





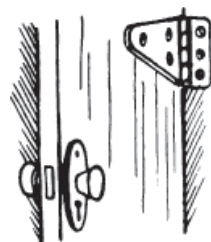
The **interior walls** are usually wallboard, made of *gypsum*.

Your **plumbing fixtures** may be made of brass (*copper* and *zinc*) or stainless steel (*iron*, *nickel* and *chrome*).



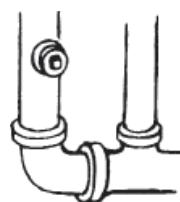
Your **windows** are made of glass (*trona*, *silica*, *sand* and *feldspar*).

Your **toilets, sinks** and **bathtubs** are made of porcelain (*clay*) over *iron*, or plastic (*petroleum*).



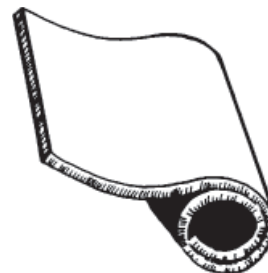
Your **door knobs, locks** and **hinges** are brass or steel (*copper*, *zinc*, *iron ore*, and *alloys*).

Your **sewer system** is made of *clay* or *iron* pipe (plastic pipes are made from *petroleum*); if you have a **septic tank** it is *concrete* and the leach field is filled with *sand* and *gravel*.



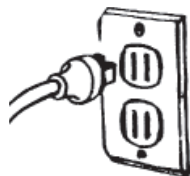
Your **fireplace** may be made of *rock*, *brick*, or you may have a wood/coal burning **stove** (*steel*, *iron*, *alloys*, *etc.*). Your **furnace** is made of steel (*iron* and *alloys*).

The **carpet** in your home is made from synthetic fibers (*petroleum*). The back is filled with *limestone*, even if your carpet is made of wool.



If your house is painted, **paint** is manufactured with *mineral fillers* and *pigments*.

And finally, your **mortgage** or **rental contract** is written on paper made from wood or cloth fibers. The fibers are filled with *clay* and *other minerals* to determine its color and texture.



Your **electrical wiring** is of *copper* or *aluminum* (*bauxite*).

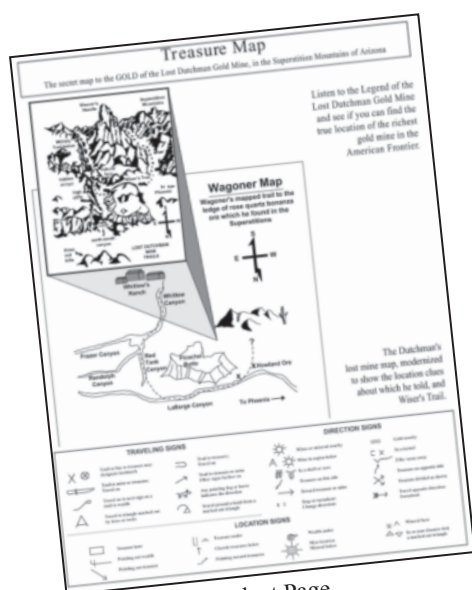
**Your House
Came Out of the Ground**

Find Out

Which of the materials used to build your house came from your community or state? Can you discover which other states, and even other countries, were involved in producing the materials that were necessary to build your house?

MINING LEGENDS

Objective: To enrich and expand the study of natural resources with literature and history.



Student Page

A Few Facts

The first documented discovery of gold in the United States was made by 12-year-old Conrad Reed in 1799 while shooting fish with a bow and arrow in a North Carolina stream. Because gold was not known to be found in this part of the country, the boy's father kept the piece for several years and used it as a doorstop. In 1802, it was properly identified by a jeweller as gold.

Gold was mined in the U.S. prior to the Revolutionary War, but authentication of those discoveries is still missing. Some regions of Arizona have been mined for more than 600 years. The fabled Seven Cities of Cibola directed Spanish exploration of the New World in the 1500's.

The discovery of gold lured thousands of people to the American Frontier, and these prospectors settled the West and Canada.

The first authenticated U.S. gold rush was in Georgia in 1828 (though many believe that the lure of gold in Georgia did not create a true gold rush). The famous California Gold Rush began in 1849; it was followed by Colorado in 1859, South Dakota in 1874, Alaska in 1898 and Nevada in 1902.

- Gold is weighed in Troy ounces: 1 pound avoirdupois = 14.58 Troy oz.
- Gold content in jewelry and other applications is measured in karats.

1 karat = 1/24th part. 24k is pure gold; 18k is 18 parts gold and 6 parts other metals. Most gold jewelry is 14k gold.

Read More About It!



- *White Fang* and *Call of the Wild*, by Jack London; Macmillan Children's Book Group
- Robert Service Series and *Yukon Poems* by Robert Service; Putnam Publishing Group

Classroom Experience

Discuss the term "legend." What is fact? What is fiction?

Working alone or in groups, students can create their own treasure maps based on various myths, legends and books. By exchanging maps, they may locate the well-known treasure from the map and clues provided.

Dig A Little Deeper

- Research other mining legends or legends of the Old West.
- To recreate the emotion of the California Gold Rush, pan for gold in your own classroom. Special classroom panning kits are available from Mii.
- Write the legend of your classroom, or have students create their own legends and share them if they wish.
- Every state has legends of buried treasure or lost wealth waiting to be rediscovered. Research your local treasure.



Integrating the Curriculum

1. How long is the course in the Iditarod race? How many miles per hour did the most recent winner average?
2. The Egyptians used a great deal of gold. Where did they find it? How was it mined? How much does the gold sarcophagus of King Tut weigh?
3. Why is there a Russian influence in Alaska?
4. What is the basic weight for Troy weight? (12 Troy ounces = 1 Troy pound) Why is it called Troy? How many Troy ounces does each student weigh?
5. Secure a street map of your community and locate the origin of its street names. Were they named for any important historical events, places or people?
6. Form several groups and have each select a decade of your state's history to research and present to the class.

Treasure Map

The secret map to the GOLD of the Lost Dutchman Gold Mine, in the Superstition Mountains of Arizona.

Listen to the Legend of the Lost Dutchman Gold Mine and see if you can find the true location of the richest gold mine in the American Frontier.

Teacher's Note

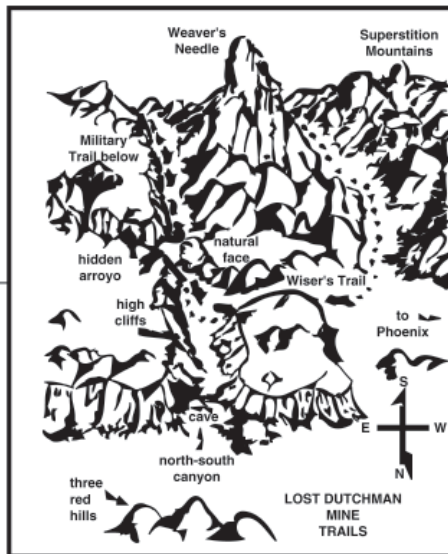
cover before copying

Students will not be able to find many clues at all that will lead them to the mine. That's why it is still lost.

Note: The Compass is "upside down".

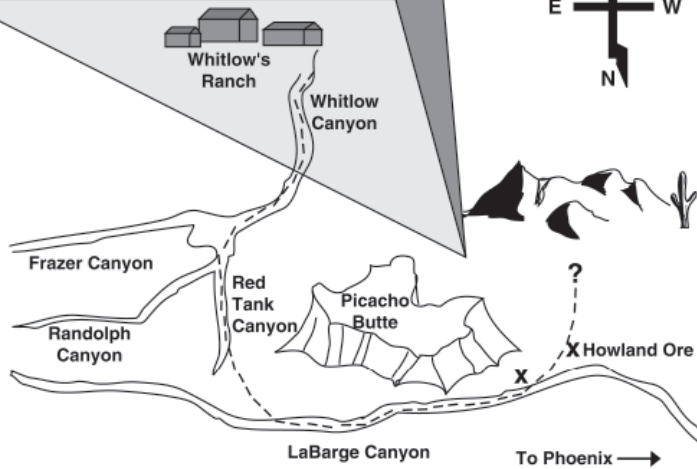
Have the students use the symbols below to create their own treasure maps.

The Dutchman's lost mine map, updated to show the location clues about which he told, and Wiser's Trail.



Wagoner Map

Wagoner's mapped trail to the ledge of rose quartz bonanza ore which he found in the Superstitions



TRAVELING SIGNS



Trail or line to treasure may designate landmark



Trail to mine or treasure; Travel on



Travel on to next sign on a trail to wealth



Travel to triangle marked out by trees or rocks



Trail to treasure; Travel on



Trail to treasure or mine Other signs further on



Any pointing dog or horse indicates the direction



Travel around a bend from a marked out triangle

DIRECTION SIGNS



Mines or mineral nearby



Mine in region below



In a shaft or cave



Treasure on this side



Toward treasure or mine Stop or turnaround; Change directions



Gold nearby



In a tunnel



Fifty varas away



Treasure in opposite side



Treasure divided as shown



Travel opposite direction



Turnaround

LOCATION SIGNS



Treasure here



Pointing out wealth



Pointing out treasure



Treasure under



Church treasures below



Pointing toward treasures



Wealth under



Mine location



Mineral below



Mineral here



In or near (locator dot)



a marked out triangle

THE LEGEND OF THE LOST DUTCHMAN

The Lost Dutchman Gold Mine, still hidden in the Superstition Mountains east of Phoenix, Arizona, has it all—fabulous wealth, Spanish treasure maps, Apaches, claim jumping and murders, including mysterious 20th Century deaths and disappearances.

450 years ago, Coronado searched the area for the Seven Golden Cities of Cibola, the legendary wealth of earlier civilizations of the Indian and Mexican empires. For centuries, the Apaches watched as foreign men brought invading hordes in search of gold in the mountains that were their god—the Superstition Mountains.

In the winter of 1847-48 the Apaches began to attack in earnest; and when all foreigners had been destroyed, the medicine men holding solemn council upon the matter stated that, should foreigners come again to disturb the gods, the Apaches might be “forever cursed by storms and floods and all manner of the natural disasters which angry deities could contrive.” So it was decreed that a band of thirty squaws and two youths would be sent back into the Superstitions to cover the mines and destroy all traces of the fabulous workings.

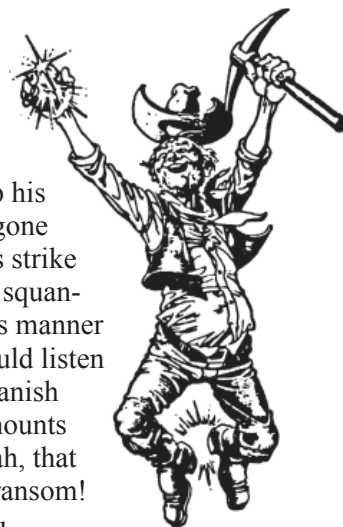
And there in the mountains this work party labored for one full moon, throwing ore and hastily abandoned tools back into the shafts. Then they covered the mines with stout logs, which in turn were covered with the natural caliche cement that hardens into rock. Over this they placed in cunning Indian fashion yet another covering of dirt and surface stones to match the surrounding ground.

In 1871, with the help of old Spanish treasure maps, Jacob Walz, “The Dutchman” and his partner, Wiser, were prospecting the Needles Canyon area of the Superstitions looking for lost Spanish gold. Both were well known throughout Arizona as “thorough-going scoundrels, capable of most anything.” At the unmistakable sound of hammering by miners, Walz grabbed his .45-90 Sharpes, and Wiser his .45-70 Springfield, and they proceeded to ambush two miners (Jacobs and Ludi) near Weaver’s Needle. Jacobs and Ludi, both mortally wounded, fled with Ludi dying soon. Jacobs stumbling on alone, finally reached Andy Starr’s cabin in the desert, where he collapsed in Starr’s arms, babbling wildly about Spanish-mapped mines and hidden ambushers before he, too, died.

Meanwhile, Walz and Wiser were examining the mine in a veritable frenzy of activity, for the fantastic ore was almost a third solid yellow gold. And, thought the Dutchman, wouldn’t that ill-gotten wealth be worth twice as much to one of them alone? The Sharpes fired again, and Wiser was left to die in the mine. However, Wiser, like the miners before him, was able to crawl from the mine and, when found delirious in the desert by friendly Pima Indians, was taken to Col. Walker’s ranch near Florence. There for days Wiser hovered between life and death, telling his incredible story of murder, bonanza gold and greedy treachery before he, too, died.

Source: *Thunder Gods Gold*, by Barry Storm

Back in the Superstitions, the Dutchman had gathered up his first sack of fabulous ore and gone to Florence, where word of his strike spread like wildfire. There he squandered his gold in an uproarious manner and regaled everyone who would listen with expansive tales of old Spanish workings and unbelievable amounts of gold. But of its location—ah, that was the secret worth a king’s ransom!



Walz vanished from Florence as abruptly as he had appeared. Then, weeks later, he turned up again with more of his fantastic ore, but this time in Phoenix for another drunken spree. He told even wilder tales than before of his bonanza, which promptly whipped the little village into such a frenzy that practically every able-bodied man there made immediate and secret preparations to follow the Dutchman. However, Walz was no fool, drunk or sober. He vanished suddenly one night, dragging a blanket behind him to wipe out his trail.

A few weeks later, he reappeared. This time after his usual spree, the Dutchman, upon leaving town, not only found a stampede-sized crowd waiting to follow but saw that many more were already camped out upon the desert hoping to intercept him. After that, he continuously changed his course. His tracks often ended abruptly, as though he had sprouted wings and flown off.

Shortly afterward, he appeared in Tucson with two burro-loads of ore. It was there it was discovered that Walz had never recorded his claim, meaning anyone who found it could own it. By this time everyone in Arizona was convinced the Dutchman was secretly working a hidden bonanza. In fact, there could have been no doubt of it in the face of his well-known ore sales and continued production of the same fabulous ore for more than six years.

In Phoenix, he rented a plot of ground and an adobe hut near Henshaw Road and 16th Street and settled down at last to a life of ease and the prosaic pastime of raising chickens and wine grapes. There he guarded his secret with all the delighted perversity of a child who knows something but won’t quite tell it.

Whenever he needed money for himself or for his small group of friends (who were in frequent need), he simply went into his backyard to a certain spot, but different each time, and dug up a tin can containing gold dust and nuggets. He did that for the next 14 years, until he died on February 22, 1891.

The Dutchman gave numerous clues, and even drew maps, as to the site of his now legendary mine, and more than a dozen have died trying to find it. The clues and maps are readily available, but America’s most famed lost gold mine is still lost.

The First Authenticated Gold Discovery in America

North Carolina - 1799

There is no doubt that gold mining occurred in "America" before the country was founded, but authentic records of discovery cannot be found. Therefore, the generally accepted first gold discovery is credited to the seventeen-pound nugget found by 12-year-old Conrad Reed in Cabarrus County, North Carolina in 1799.

According to *Historical Sketches of North Carolina 1584 to 1851*, by John H. Wheeler:

The first piece of gold found at the mine was in the year 1799, by Conrad Reed, a boy of about twelve years old, a son of John Reed, the proprietor. The discovery was made in an accidental manner. The boy above named, in company with a sister and younger brother, went to a small stream, called Meadow Creek, on a Sabbath day, while their parents were at church, for the purpose of shooting fish with bow and arrow, and while engaged along the bank of the creek, Conrad saw a yellow substance shining in the water. He went in and picked it up, and found it to be some kind of metal, and carried it home. Mr. Reed examined it, but gold was unknown in this part of the country at that time, he did not know what kind of metal it was: the piece was about the size of a small smoothing iron.

Mr. Reed carried the piece of metal to Concord, and showed it to a William Atkinson, a silversmith, but he not thinking of gold, was unable to say what kind of metal it was.

Mr. Reed kept the piece for several years on his house floor, to lay against the door to keep it from shutting. In the year 1802, he went to market to Fayetteville, and carried the piece of metal with him, and on showing it to a jeweller, the jeweller immediately told him it was gold, and requested Mr. Reed to leave the metal with him and said he

would flux it. Mr. Reed left it, and returned in a short time, and on his return the jeweller showed him a large bar of gold, six or eight inches long. The jeweller then asked Mr. Reed what he would take for the bar. Mr. Reed, not knowing the value of gold, thought he would ask a "big price" and so he asked three dollars and fifty cents (\$3.50)! The jeweller paid him his price.

After returning home, Mr. Reed examined and found gold in the surface along the creek. He then



associated Frederick Kisor, James Love, and Martin Phifer with himself, and in the year 1803, they found a piece of gold in the branch that weighted twenty-eight pounds. Numerous pieces were found at this mine weighting from sixteen pounds down to the smallest particles. The whole surface along the creek for nearly a mile was very rich in gold.

The veins of this mine were discovered in the year 1831. They yielded a large quantity of gold. The veins are flint and quartz.

"I do certify that the foregoing is a true statement of the discovery and history of this mine, as given by John Reed and his son Conrad Reed, now both dead."

George Barnhardt, January, 1848

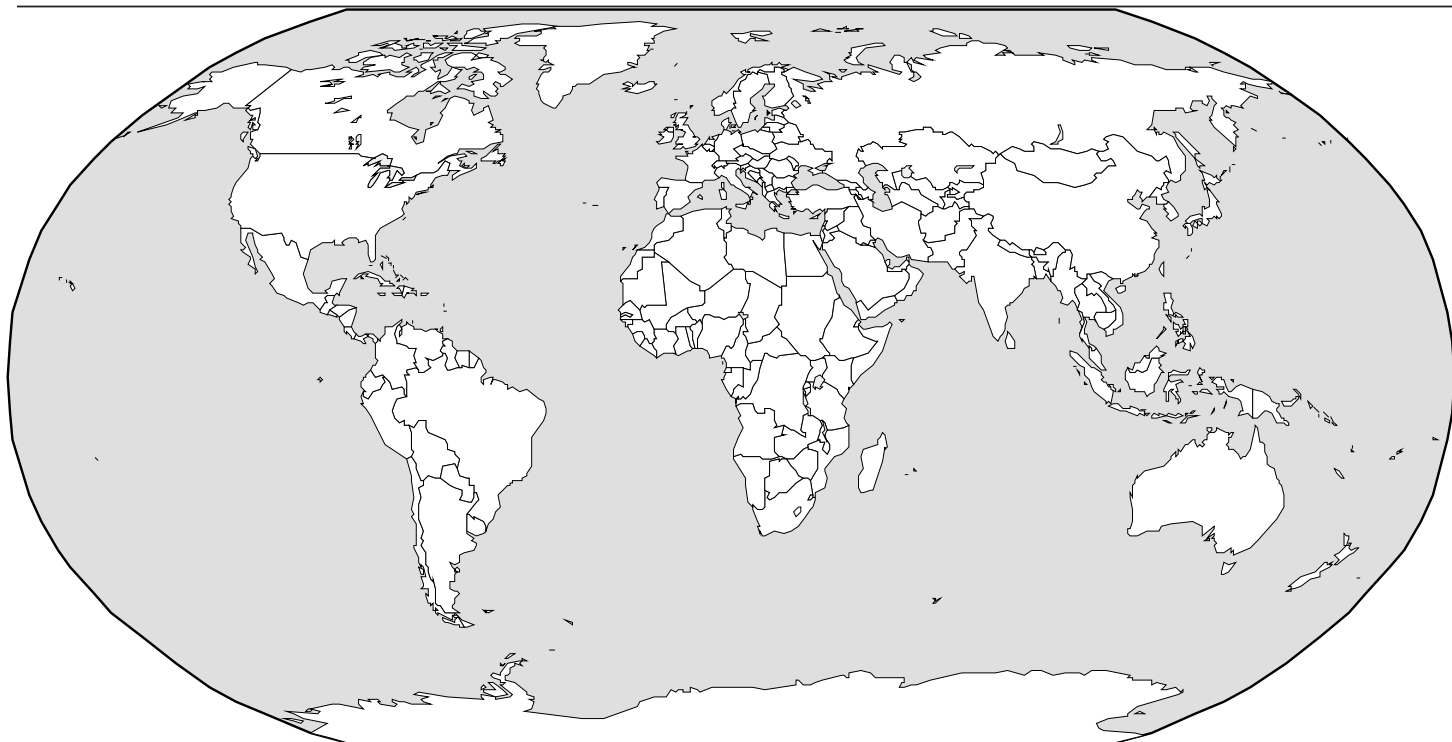
Objective: To discover that worldwide cooperation is necessary to make most products.

[illegible]

27

Where Do Our Resources Come From?

Something as common as a light bulb is made from the minerals and metals from nearly a dozen different countries.



Using other reference sources, find the reason why different metals are needed to make a light bulb, and the major countries where these metals are produced.

Bulb
Soft glass is generally used, made from *silica*, *trona* (soda ash), *lime*, *coal*, and *salt*. Hard glass, made from the same minerals, is used for some lamps to withstand higher temperatures and for protection against breakage.

Gas
Usually a mixture of *nitrogen* and *argon* to retard evaporation of the filament.

Support wires
Molybdenum wires support the filament.

Button & Button Rod
Glass, made from the same materials listed for the bulb (plus *lead*), is used to support and to hold the tie wires in it.

Heat Deflector
Used in higher wattage bulbs to reduce the circulation of hot gases into the neck of the bulb. It's made of *aluminum*.

Base
Made of *brass* (*copper* and *zinc*) or *aluminum*. One lead-in wire is soldered to the center contact and the other soldered to the base.

Filament
Usually is made of *tungsten*. The filament may be a straight wire, a coil, or a coiled-coil.

Lead-in-wires
Made of *copper* and *nickel* to carry the current to and from the filament.

Tie Wires
Molybdenum wires support lead-in wires.

Stem Press
The wires in the glass are made of a combination of *nickel-iron* alloy core and a *copper* sleeve.

Fuse
Protects the lamp and circuit if the filament arcs. Made of *nickel*, *manganese*, *copper* and/or *silicon* alloys.

Don't forget the mineral fuels needed to generate the electricity to light up the bulb. In the United States, these are the sources of our fuels used to generate electricity.

Coal	Nuclear	Hydro	Natural Gas	Oil	Other
45%	20%	7%	23%	2%	3%

Source: Energy Information Administration

RECYCLING METALS

Objective: To appreciate our roles in producing and sharing our natural resources.

A Few Facts

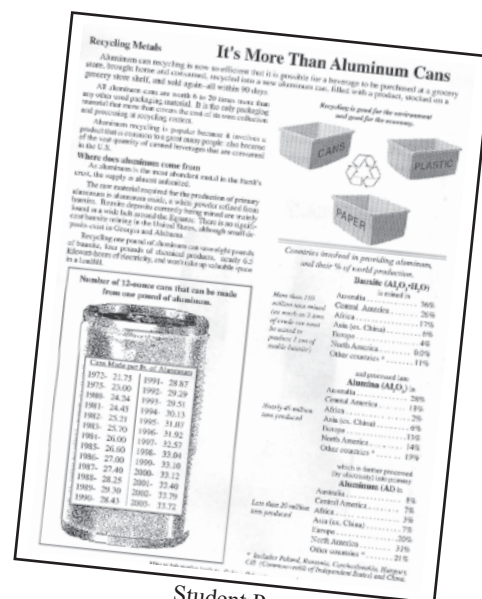
In the U.S., 5,500,000 metric tons of aluminum are used each year, and 37% of that is made from recycled aluminum products.

But believe it or not, when it comes to recycled metals, aluminum is not the leader. The recycling of other metals isn't generally well-known because it's done by industry, not by consumers.

In 2004, the recycling rate for steel from automobiles was 102%. How can that be? It means more steel was recovered by recycling old automobiles than was used that year to make new autos.

Important Metals Used and Recycled in the U.S.

Kind of metal	% Recycled	Kind of metal	% Recycled
Aluminum	43	Magnesium	48
Aluminum in bev. cans	54	Nickel	45
Chromium	36	Tin	25
Copper	32	Titanium	47
Iron & steel	71	Zinc	30
Lead	81		



Classroom Experience

What do minerals have to do with world development?

Track and research the economic, manufacturing and industrial developments and trends in mainland China and the former Soviet Union. Are the regions with more mineral resources being developed more rapidly? Will there be less natural famine, a higher standard of living, opportunities for a better education, etc.?

Debate the various uses for different metals – the benefits of one metal versus another for the same application.

With mapping exercises, help the students discover that bauxite mining does indeed occur close to the equator, while processing it into aluminum occurs not only in other countries, but on other continents as well.

Dig A Little Deeper

Have your students form groups and research these questions:



- Why is aluminum used in beverage cans, storm window and door frames, bicycles and backpacks?
- If the price of aluminum increases, should we still use it to make beverage cans?
- Why is recycling aluminum so popular?
- Why can we make more 12-ounce cans today from a pound of aluminum than we could 20 years ago?
- How can people help recycle metals other than aluminum?

Integrating the Curriculum

1. Research the energy efficiency of automobiles required by Congress and the EPA and its effect on oil self-sufficiency. Are we producing a cleaner environment through efficiency and innovation? Can we recycle our way to self-sufficiency in minerals?
2. 54% of all aluminum beverage cans were recycled, yet aluminum represents about 2% of all recovered recyclables. Study your home or school trash to see what else can be recycled.
3. Help your students pick a project that supports the environment and develops community pride, such as using the proceeds from a recycling drive.

Student Page

Read More About It!

Check out these books for your class:

- *Garbage Pizza, Patchwork Quilts and Math Magic* by Susan Ohanian; W.H. Freeman and Company
- *50 Simple Things Kids Can Do to Recycle*; Earth Works Group



Recycling Metals

It's More Than Aluminum Cans

Aluminum can recycling is now so efficient that it is possible for a beverage to be purchased at a grocery store, brought home and consumed, recycled into a new aluminum can, filled with a product, stocked on a grocery store shelf, and sold again—all within 90 days.

All aluminum cans are worth 6 to 20 times more than any other used packaging material. It is the only packaging material that more than covers the cost of its own collection and processing at recycling centers.

Aluminum recycling is popular because it involves a product that is common to a great many people; also because of the vast quantity of canned beverages that are consumed in the U.S.

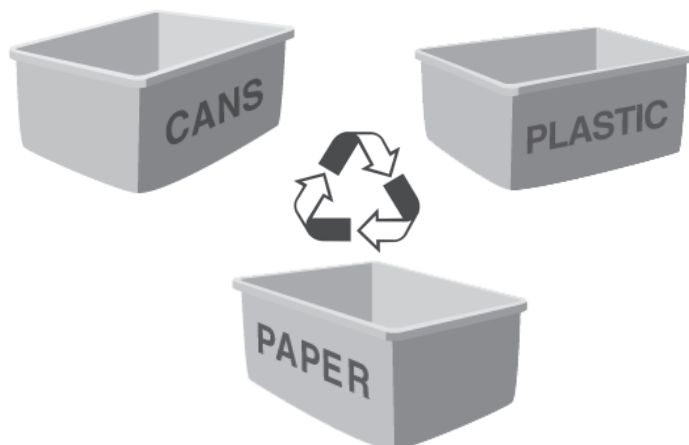
Where does aluminum come from

Aluminum is the most abundant metal in the Earth's crust, but most of it occurs in minerals that are too expensive to process, except for the mineral *Bauxite*.

Bauxite deposits currently being mined are mainly found in a wide belt around the Equator. There is no bauxite mining in the United States, although small deposits exist in Georgia and Alabama.

Recycling one pound of aluminum can save eight pounds of bauxite, four pounds of chemical products, nearly 6.5 kilowatt-hours of electricity, and won't take up valuable space in a landfill.

*Recycling is good for the environment
and good for the economy.*



*Countries involved in providing aluminum,
and their % of world production.*

Bauxite ($\text{Al}_2\text{O}_3 \cdot \text{H}_2\text{O}$)

is mined in

Australia	34%
China	17%
Brazil	13%
Guinea	7%
Jamaica	7%
India	7%
United States	0.0%
Other countries	16%

and processed into

Alumina (Al_2O_3) in

Australia	25%
China	19%
Brazil	9%
United States	7%
Jamaica	6%
Russia	5%
20 Other countries	29%

which is further processed
(by electricity) into primary

Aluminum (Al) in

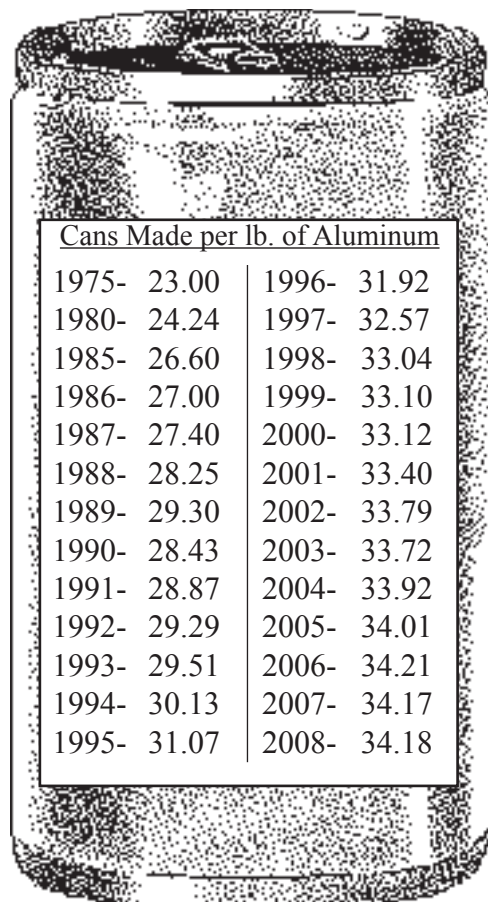
China	18%
Russia	12%
United States	10%
Canada	9%
Australia	6%
Brazil	5%
Norway	4%

*More than 190 million
tons of bauxite is mined
worldwide, each year.
Two to three tons of
bauxite are required
to produce one ton of
alumina.*

*More than 70 million
tons of Alumina is
produced, worldwide.
Two tons of alumina
produces one ton of
aluminium metal.
NOTE: The U.S. mines
no bauxite but produces
7% of the world's
alumina.*

*More than 33 million
tons of Aluminum Metal
is produced, worldwide.
NOTE: Norway mines
no bauxite, produces no
alumina, but provides
4% of the world's
aluminum metal.*

Number of 12-ounce cans that can be made from one pound of aluminum.



How Do We Use Our Land?

Objective: To appreciate our roles in producing and sharing our natural resources.

A Few Facts

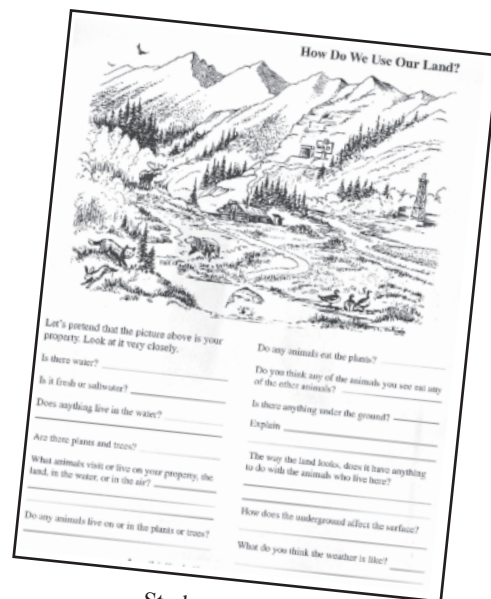
Almost all property in the United States and Canada is controlled by land use regulations. Invite your local land use official to visit your class to discuss local permit rules. Some interesting areas to explore are:

- Land use: zoning laws, building permits, sewage disposal permits, well permits and business licenses.
- Living off the land: hunting and fishing licenses, mining and lumbering permits, housing code approval.

How big is an acre? Unless you live in an agricultural community, acres and hectares are hard for most people to visualize, yet almost all land uses are related to these two measurements.

- 1 acre = 43,560 sq. feet 1 hectare = 107,600 sq. feet

A high school football field equals about an acre. A hectare equals about 2½ football fields.



Student Page

Classroom Experience

Visit a football field with your class. Encourage them to measure it in many different ways. (They could measure it in time; it would take a 10-year-old nearly 3 minutes to run around one acre.) Estimate how many houses would fit in that space. How large should each house and yard be?

Cooperatively have the class decide what support space would be needed and shared, for roads, some open space, utility poles, etc. The class can then draw up a list of the people to be employed to develop the football field into housing.

Research and discuss: Not all land is suitable for all uses.

You need land (somewhere) for agriculture so you can eat.

You need land (somewhere) for houses so you have a place to live.

You need land (somewhere) for mining to make the things you need.

Our interdependence as a society relies on a limited amount of land and the need to have a continual supply of resources and different uses from that land. Is there a land use we can really do without?

Read More About It!

Check out these children's books for your class:

- *Sugaring Time* by Kathryn Lasky; Macmillan Children's Book Group
- *Cranberries* by William Jasperson; Houghton Mifflin
- *Farming* by Gail Gibbons; Holiday House
- *Reflections of a Black Cowboy* by Robert Miller; Silver Burdett Press
- *Luck of the Roaring Camp* by Bret Harte; Dover Publications

Integrating the Curriculum

1. Develop a plan for a new city, with all support services as well as transportation to other cities. Give the class a limited amount of space and have them discuss (and compromise on) use of land for athletic fields or a homeless shelter.
2. Borrow soil testing materials (and an expert if you can) from your local Soil Conservation Service. Test the soil around the school and discuss soil assays' role in land development. What soil makes the best ballpark? What soil supports a building best?
3. Read a report on the quarrels between ranchers and farmers in the settlement of the west. Suggest that your class construct and role-play a court case involving these two warring factions.
4. If a television tower needed to be put in your neighborhood, how would you feel? Why? What are the alternatives?

Dig A Little Deeper



- When the class has developed its plan for the football field (this can easily be done on a computer), ask a representative from the Planning and Zoning agency to come and discuss why – or why not – building permission would be given.
- Research the building of early frontier towns and the building of towns in the thirteen original colonies. Were housing problems different?
- After World War II, when England was rebuilding its cities, it provided for "green space" at specific distances throughout the city. What was the reason?

How Do We Use Our Land? *Part I*



Let's pretend that the picture above is your property. Look at it very closely.

Is there water? _____

Is it fresh or saltwater? _____

Does anything live in the water? _____

Are there plants and trees? _____

What animals visit or live on your property, the land, in the water, or in the air? _____

Do any animals live on or in the plants or trees? _____

Do any animals eat the plants? _____

Do you think any of the animals you see eat any of the other animals? _____

Is there anything under the ground? _____

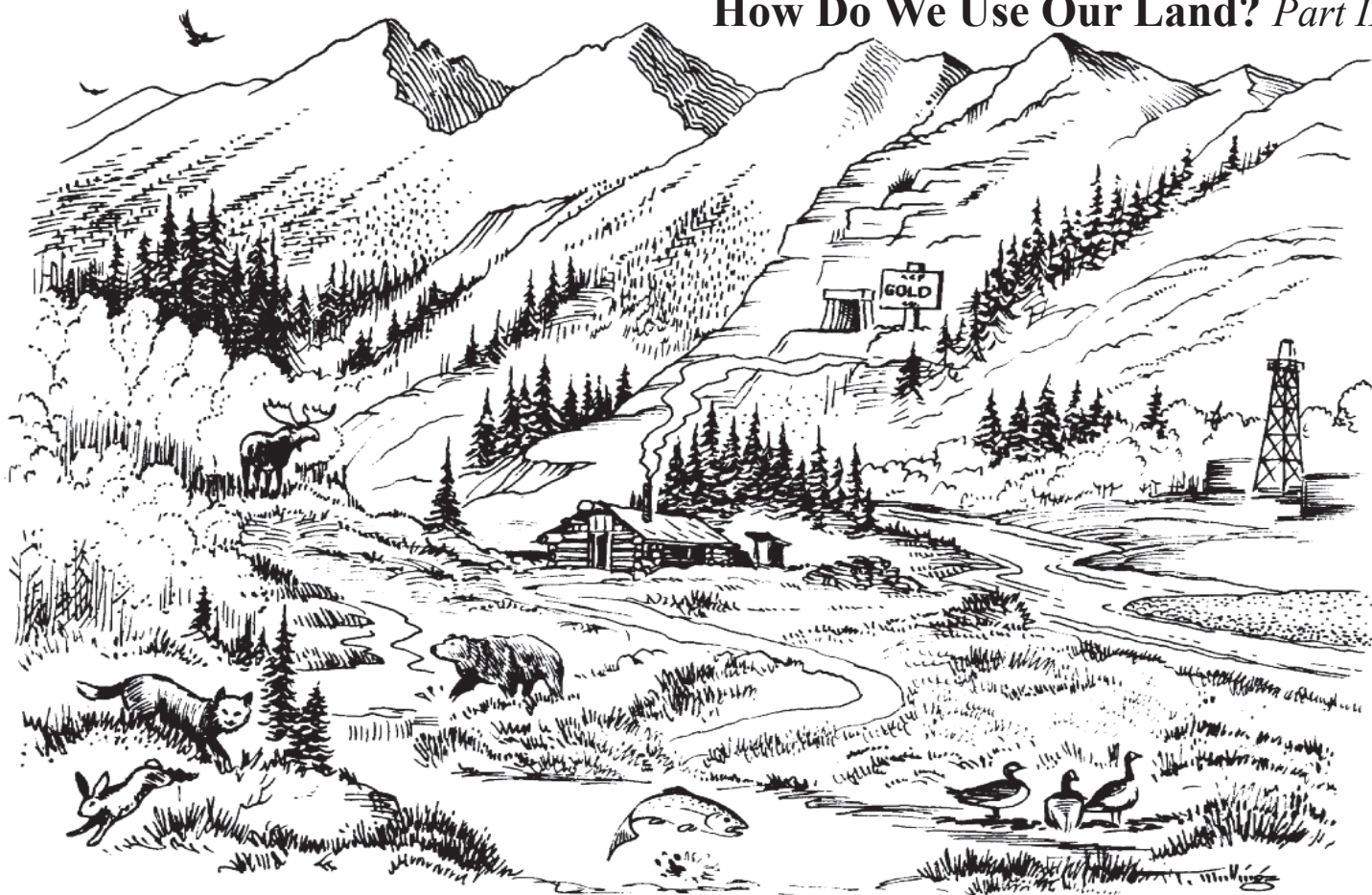
Explain _____

The way the land looks, does it have anything to do with the animals who live here?

How does the underground affect the surface?

What do you think the weather is like? _____

How Do We Use Our Land? *Part II*



Look at the property again. Draw a picture of yourself in the middle of it.

What other questions would you ask?

How do you think you would like living here?

What do you like most about this place?

What kinds of things would you do when you are on your property? What kind of hobby could you have? _____

Name your property. Write a short story about how you spend a day there.

Imagine that this property has been owned by your family for many, many years. Although your family has always lived in the nearby town, most of the time in the past you have visited the property during vacation.

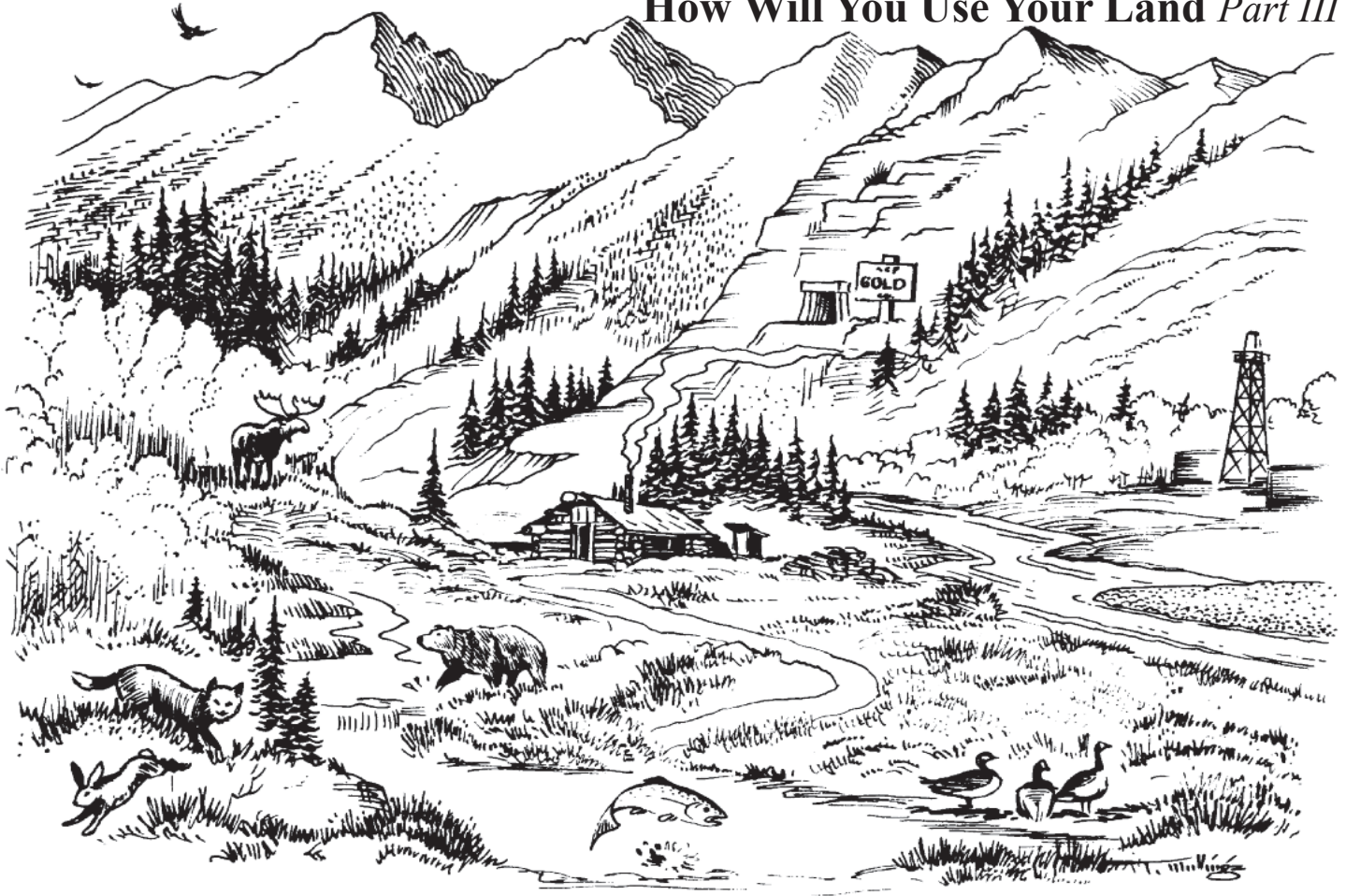
What will you do with the property in the next year? _____

What could you do with the property in the next five years? How might you use it?

You have made a land use decision. You did this based on what you know about the land and how you feel about it.

As a land manager this was the first of many decisions you will make about your land.

How Will You Use Your Land *Part III*



Look at the picture again. Things have changed since you first received your land. Your family finds itself without a source of income. Your property is your only means of support. You must make a living from your property and provide food, shelter, and a cash income to provide for your other needs.

How could you provide your food? _____

How will you provide shelter for your family?

What resources on your property could you use to make money? How would you do so?

Remember, when you make decisions about how to use your resources, you are making an *economic* choice.

You have just made land management decisions based on your economic needs and wants. This is part of what a good land manager must do.

When you had to make decisions about your land, were you wishing you had more land? Maybe you wanted one piece of property with which to make money and another piece of land to enjoy. The problem you faced is the same one other landowners everywhere face. There is only so much land on our Earth from which we make our living and receive pleasure.

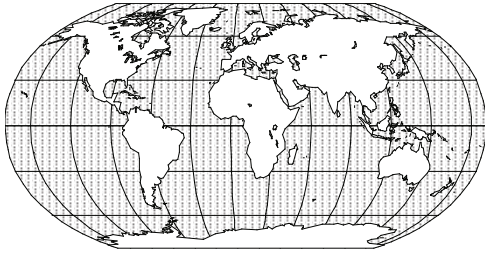
Being able to live off the land and also enjoy it, requires good problem solving and decision making skills. Many times, land can provide more than just one use.

Note: What might happen if you and all your neighbors created hunting lodges or recreational resorts?

Source: Alaska Mineral and Energy Resource Education Fund (AMEREF)



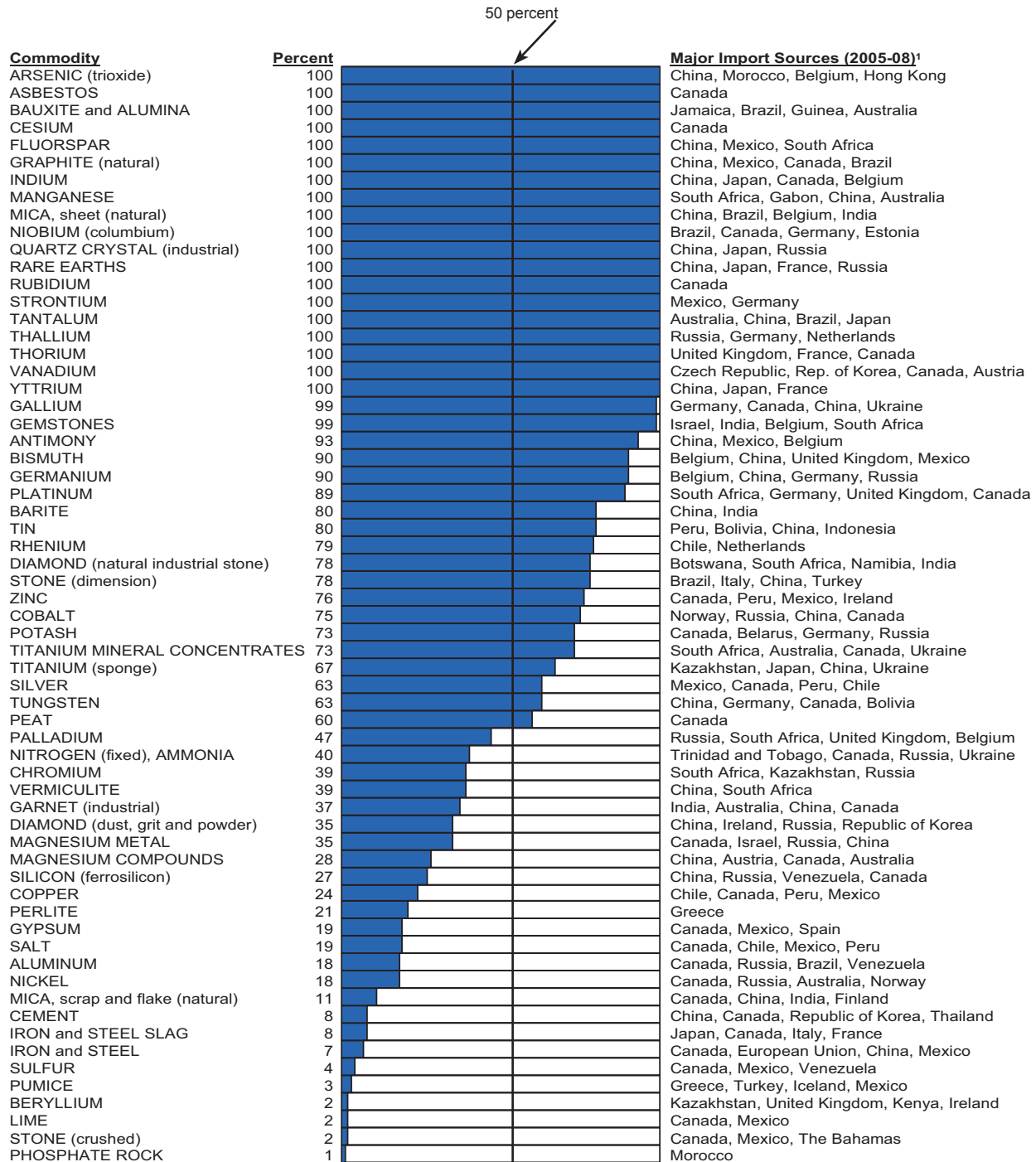
When a mine is finished, the land will be reclaimed
so it can be used again, whether by man or by nature, or both.



Minerals Imported by the United States

In spite of its size and mineral wealth, the United States is not able to produce all of the minerals it needs to be self-sufficient. To maintain our lifestyle and provide all of the consumer products and infrastructure we use everyday, various amounts of the following minerals must be imported from foreign countries.

United States Imports of Selected Nonfuel Minerals & Metals



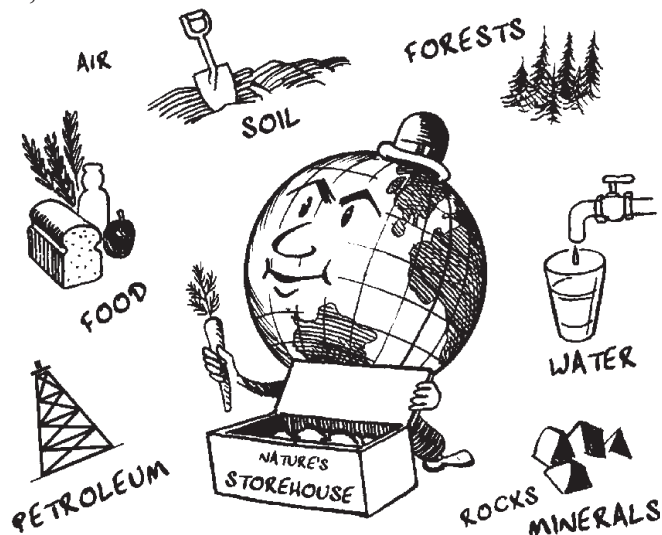
¹In descending order of import share.

Source: U.S. Geological Survey, Mineral Information Team

THE EARTH—NATURE'S STOREHOUSE

The Earth is a huge storehouse. It holds the water and food that plants need to grow. It has a great supply of other natural materials. Materials people use are called natural resources.

Natural resources are useful materials found on and under the Earth's surface. You use a variety of natural resources everyday. Food is a natural resource—so is water. Other resources include soil, trees, and minerals.



WHAT ARE MINERAL RESOURCES?

Mineral resources are found on and in the Earth's crust. More than 3,500 different minerals have been identified. We will study three classes of mineral resources—metals, nonmetals, and fuels. Copper, nickel, gold, silver, and iron are examples of metallic mineral resources. Common materials like sand, gravel, clay, limestone, and salt are examples of nonmetallic mineral resources. Nonmetallic minerals are often called *industrial minerals*. Minerals used for fuel are oil, gas, and coal. They are called *fossil fuels*. Uranium is a *metallic fuel*.

Minerals are everywhere around us. For example, it is estimated that more than 70 million tons of gold is in the ocean waters. It would be much too expensive to recover because it is so scattered. Minerals need to be concentrated into deposits by Earth's natural processes to be useful to us.

Some of Earth's natural processes concentrate mineral resources into valuable deposits. Moving water places sand and gravel along stream and river banks and ocean beaches. Water erodes gold-bearing rock from upland mountains and deposits gold in gravels along some rivers and streams.

Inside the Earth, rocks are melting and cooling. Melting and cooling can concentrate metals such as copper, molybdenum, nickel, and tin in a rock mass along with other common minerals like quartz and feldspar.

On the surface of the Earth, dead plants accumulated in swamps millions of years ago. Through time, heat and pressure, that plant material has become today's coal. Oil and natural gas have come from algae, spores, and plant material. Minerals may be everywhere, but only in a few places are they concentrated enough to make them valuable to us.

Mineral resources such as oil and gas, coal, copper, and tin, are called nonrenewable resources. Once they are removed from the Earth, they will not be replaced in our lifetimes. However, new mineral wealth is being created by such natural forces as volcanic activity and earthquakes.

HOW ARE MINERAL RESOURCES DISTRIBUTED THROUGHOUT THE EARTH?

Minerals are not evenly distributed in the Earth's crust. Concentrations of mineral resources profitable to extract are found in just a few small areas. Mineral deposits are really freaks of nature. In other words, a special set of circumstances happened in or on the Earth to create mineral deposits. There had to be a supply of certain elements available in the Earth, a process to concentrate them, and a host rock to trap the mineral or minerals. Many minerals like to be together, such as: quartz and gold; molybdenum, tin and tungsten; copper, lead and zinc; platinum and palladium—to name a few.

The signs of a mineral deposit are often small and difficult to recognize. Locating deposits requires the experience and knowledge of a trained geologist. Geologists search for years before finding an economic mineral deposit. Deposit size, its mineral content, extracting efficiency, and costs—ALL determine if a mineral resource can be profitably developed.

HOW ARE MINERAL RESOURCES USED TO SUPPLY FOOD?

Our food supply depends on mineral and energy resources. Farming starts with seeds in the ground and ends with food for us to eat. Plants come directly to us as fruits and vegetables—or—indirectly as food from animals that supply dairy products and meat. Growing plants get food (nourishment) from minerals in the soil. Fertilizers—such as potash, phosphate, nitrogen, and sulfur—are necessary to produce abundant crops.

That is just a start. The farmer's truck, tractor, and other machines are made from steel and other metal products. Power to operate the equipment is provided by fossil fuels such as gasoline and diesel fuel. The food products from the farm are shipped to processors or to markets in trucks, railway cars, and airplanes—all made from iron, manganese, nickel, molybdenum, and aluminum and many other minerals. The roads, highways, railroads, and airports used for food transportation are made using other mineral resources. Food is processed using equipment made from metal. Food packaging commonly is made of metal or containers made from petroleum products (such as plastic).

WHAT PRODUCTS ARE MADE FROM MINERAL RESOURCES?

Nearly ALL of the products we need to make our life more comfortable are made from mineral resources. Our society as we know it today could not function without a large and varied supply of minerals.

All products used at home, at play, and at work come from the Earth. Food, shelter, water supply, clothing, health aides, transportation, and communication all depend on mineral resources. We can see products made from minerals in the kitchen and on the dining room table. Stoves, refrigerators, dishwashers, toasters, forks, knives are good examples.

Nickel, copper, stainless steel, aluminum, and silver are necessary in cooking and eating. These products are more convenient and long-lasting and are more beneficial to our safety and health than wooden spoons, ice boxes, and dishpans.

HOW DO MINERAL RESOURCES CONTRIBUTE TO THE HOME AND INDUSTRY?

The raw materials of Earth are used to make equipment and consumer products. They are sometimes used by themselves, copper for example, or in combination with other minerals, for example: chrome, carbon and iron to make stainless steel. The output of our mines and wells makes almost every other product possible. We depend on mineral resources—they are the “building blocks” of civilization.

At home, we have instant clean water by turning on the faucet. The water treatment plant and the chemicals used for purification, the pipes and plumbing parts which bring us our water, and our waste disposal systems—are made entirely from mineral resources.

Our clothing depends on the production of mineral resources. Natural fibers grown with the aid of fertilizers are made into cloth with tools and machines made from minerals. Some textiles are made from coal and petroleum. They are called *synthetic materials*. Many coloring dyes come from minerals. Not only are these dyes used in our clothing, but are used in paints—both for household and industrial usage and works of art.

Homes, apartments, office buildings and factories are built using minerals. The structures use steel beams, gypsum for wallboard, copper wiring for telephones and electricity, and in equipment such as elevators. Zinc-coated heating ducts prevent corrosion (or rusting). The buildings sit on concrete foundations made of sand, gravel, and cement in which reinforced steel rods are embedded.

When we begin to think and investigate, we find the use of minerals is more dramatic and exciting than one can realize.

HOW ARE MINERALS USED IN TRANSPORTATION AND COMMUNICATIONS?

We now travel more and faster. We communicate by telephone, radio, and television. What has made this possible? Technology!

Aren't we glad that someone in our past invented the train? (It sure beats the horse and buggy or the wagon train.) The train, made of steel and wood, was fired by coal (eventually converted to diesel-fueled engines) that made it the transportation mode of the day. Today, we have airplanes as well as trains and automobiles.

The airplane—all of its components come from the raw materials of Earth—the same as the train and car! But, what makes it fly? What fuels it?—A highly refined kerosene made from petroleum, giving it power. It is made of light weight metals (aluminum, and specialty steels called alloys), and plastics that come from petroleum products. Its speed, because it is lightweight, makes it possible for us to travel from one coast to another in 6-1/2 hours or less.

The telephone—sure beats smoke signals! A review of history tells how exciting it was to listen to the radio and to call a friend instead of writing a letter. Today, radios,

telephones, and television sets command your attention. None of these conveniences could have been made, except “someone” was interested in the advancement of society and knew how to use minerals. An understanding of minerals—the connectors so vital in today's communications—is important. As you work with your classroom computers remember that it was just a few years ago that they were made available to your school. And who could have imagined what a quartz crystal could do? But that quartz crystal (silicon chip) could not work alone if other minerals were not used at the same time. We are lucky!

HOW DOES THE USE AND SUPPLY OF RESOURCES DIFFER AMONG PEOPLE AND PLACES?

Mineral and energy resources are essential to everyone. A nation cannot enjoy prosperity without a reliable source. No country is entirely self sufficient when it comes to minerals and needs. Because of this interdependency, countries of the world need to cooperate.

The United States is one of the most highly industrialized nations in the world. We have a high standard of living because of our mineral and energy resource base. We have 5% of the world's population and 7% of the world's land area, but we use about 30% of the world's mineral resources. Our needs, which the consumer demands, are so large that we must buy many resources from other countries. This is called *importing*. The need for mineral and energy resources in the world continues to grow and is a major part of world trade.

WHAT IS THE FUTURE OF MINERAL RESOURCES IN THE WORLD?

The growing use of mineral and energy resources throughout the world creates several important questions. Will we reach a time when our resources are gone? It is doubtful because we are so creative and continue to develop new technology that makes minerals we use go further. We also have learned, and continue to learn, how to use our resources more efficiently and how to recycle and conserve them. Will technological development, economic factors, and conservation methods overcome fears of running out of our mineral and energy resources? Will we someday mine the ocean and resources in outer space? The answers to these questions will help determine our way of life in the future. You will be challenged to develop new ideas and new technology in the years ahead.

DIG A LITTLE DEEPER

- What does the word *concentrate* mean? Why is it important to have minerals concentrated in one place rather than scattered all around? What processes help in concentrating mineral resources?
- Name at least 3 important natural resources that can be found in your state. Why are these important?
- Pick out your favorite clothes. Look at the tags sewn inside and learn if they are made from natural fibers, synthetic fibers or both. List the fibers used to make your clothes. How did minerals play a part in the making of your clothes?
(Hint—Don't forget the *sewing machine*)

GEOLOGY and NATURAL RESOURCE DEVELOPMENT

Geology is a study of the Earth and its history as recorded in the rocks. The study of geology involves understanding the relationship between the rocks of the crust of the Earth and envelopes of air and water. Geology is a study of processes—processes that form continents and ocean basins, mountains and oceanic deeps, glaciers and lakes, sand bars and rocky cliffs, and deposits of minerals, coal and oil and gas. Geologists study rocks to determine what the Earth was like thousands, millions, and billions of years ago. Geologists study volcanoes, lavas, earthquakes, and landslides. They discover how our mineral deposits formed. They give us theories on how the Earth was formed, how it developed, and what the core of the Earth is like. The Earth is about 4.5 billion years old. Geology tells us how the Earth has changed and continues to change. Hills are worn down to form lowlands that may be covered by the sea. Millions of years later, rocks from under the sea may be raised up to form high mountains. The Earth is the geologists' laboratory.

WHY IS AN UNDERSTANDING OF GEOLOGY IMPORTANT TO ME?

The Earth is where we live. We are dependent upon our Earth. Our water supply and our farm land formed by geologic processes. All our minerals, fuels, and construction materials come from the Earth's crust. The Earth will remain a nice place to live if we use our resources wisely and control our wastes and garbage. There are natural earth hazards like floods, landslides, earthquakes, and volcanic eruptions. The understanding of geology can lead us to the safest areas in which to build cities, dams, schools, or roads and tunnels. If we understand geologic processes we will know the best places to dispose of our wastes and garbage, and the best geologic environments for finding oil, gas, and coal.

If we understand geology we can learn ways to use the resources of the Earth and at the same time protect it from harm.

HOW DOES GEOLOGY RELATE TO MINERAL RESOURCES AND THEIR DEVELOPMENT?

Mineral resources are those minerals and other earth materials that supply the things we need and want. Look around you. Things made from mineral resources are in plain sight. Some are obvious, others are less obvious. Obviously, metal paper clips and building stone come from the Earth. Some things not so obvious—toothpaste, hair combs, chalk, cups and glasses—also come from the Earth. All plastics and many fibers of which our clothes are made come from coal or oil.

Mineral resources are so important to us that we count stages of history by them. We had the *Stone Age*, the *Bronze Age*, and the *Iron Age*.

By examining different kinds of rock formations and by studying the Earth's surface, geologists know the geologic environments in which mineral resources may be found.

For a long time people were able to find enough mineral resources on the surface of the Earth. This is not the case with many mineral resources today. Once a vein of silver or a bed of coal has been mined, it cannot be replaced. This means we must plan well ahead to look for new mineral deposits.

Today, geologists use a variety of tools and instruments to help locate mineral resources. Airplanes and helicopters with photographic equipment are used by geologists. They also use magnetic and gravity-detecting equipment. This equipment gives information about the Earth's subsurface. Geologists sometimes use pictures taken from satellites in their search for hidden mineral resources.



In Canada, geologists have trained dogs to sniff out exploration clues. German Shepherds have been taught to use their excellent sense of smell to find sulfides of lead, zinc, copper, nickel, molybdenum, and silver.

HOW WERE MINERAL RESOURCES FORMED?

As the Earth changes, different types of rocks are formed. There are three types of rocks: igneous, sedimentary, and metamorphic.

Igneous rocks are formed from magma (hot melted rock) as it cools and becomes solid. As hot magma cools, minerals such as chromite (chrome is used in stainless steel) and platinum (used in catalytic converters) form.

Sedimentary rocks are formed from particles of older rocks. The particles are deposited in a body of water, a valley, or a low plain. The collection of particles is known as sediment. After the particles are deposited, new sediment is deposited on top burying the earlier deposited materials. When sediments are buried, they become cemented to form sedimentary rock. Limestone (used to make cement and statues) and clay (used to make dishes) are examples of sedimentary rocks.

Metamorphic rocks are formed in the Earth where there is high temperature and great pressure. The heat and pressure change one kind of rock into another kind of rock. This process of change is known as metamorphism. You can think of the change from brownie dough to brownies as metamorphism. Marble (used in buildings) is metamorphosed limestone. A mineral from which tungsten (light bulb filaments are made of tungsten) is produced is formed by metamorphism. As igneous, sedimentary, and metamorphic rocks are made, minerals may be so concentrated as to become resources for us to use.

The Earth is always changing. Rocks are slowly worn down by the forces of weathering and erosion. Rocks can be lifted or pushed downward. They also can be moved sideways and tilted.

For example, dead trees and plants accumulate in bogs and later are buried between layers of clay and mud. The layers become sedimentary rock. The dead trees and plants are slowly changed to coal. We might say metamorphosed to coal. Oil and gas also formed in sedimentary rock, they came from decayed animals and plants.

Today, these processes continue. New coal beds are being formed in bogs and swamps, mineral deposits are being created on ocean floors by volcanic activity. Our Earth is, indeed, an exciting place to be!

WHAT IS MINERAL RESOURCE DEVELOPMENT?

Mineral resource development is finding, removing, and processing valuable mineral resources from our Earth. Mineral resources may be solid (coal or copper), liquid (petroleum), or gaseous (natural gas).

When a mineral resource is developed, it is taken from the Earth and changed into a usable form. All the work involved in doing this has one aim: to provide us with the products we need or want in our everyday lives.

A mineral resource is developed **ONLY** when enough of it is found concentrated in one location and its removal and processing can be done profitably. Exploration for mineral resources is a very risky business and much of it is unsuccessful. Mineral resources are scarce and difficult to find. Great sums of money are spent for years before any money is ever made by a company on its mining or drilling operations. Mineral resources can be developed only if their extraction can pay for the investment, labor and machinery, and taxes. If there is no profit left over, there is no reason to invest in such a risky business.

WHAT MUST HAPPEN TO A MINERAL RESOURCE BEFORE IT BECOMES USEFUL?

Mineral and energy resources are the ingredients in nearly all of the products we use everyday. These resources must go through a number of steps or processes before usable items can be produced. We call these steps the journey from prospect to production.

EXPLORATION. First, the mineral and energy resources must be found! The people who look for these resources are called geologists. They explore the Earth to find deposits or wells that can be produced.

EXTRACTION. After the resources are located, they must be removed from the Earth. This process is called extraction. People build surface or underground mines to extract mineral resources. To get oil, holes are drilled deep into the Earth. Mining and drilling are two ways we extract and produce mineral resources.

PROCESSING. Valuable minerals are in ordinary looking rock when they are taken from the Earth. They are often hidden as tiny particles in the rock. The valuable minerals are removed from the rock and concentrated. This is called processing or crushing, grinding, and milling.

REFINING. Some minerals have to be smelted and refined before they can be made into useful products. When oil is pumped from the Earth, it is in crude form. The crude oil is sent to a refinery where it is processed into oils, solvents, fuels, and petrochemicals.

MANUFACTURING. After the mineral and energy resources are refined, these raw materials are made into products. Their transformation into consumer products is almost limitless. Products ranging from fertilizers to plastic, from bicycles to airplanes, are made by man and machinery. This is called manufacturing.

MARKETING. Once the products are made, they are sold or marketed. When you need a product, you usually go to a store. Marketing is when some product is sold to someone. The mineral and energy resource company sells the mineral resource to a manufacturer. The manufacturer makes a product and sells it to stores. The stores then sell the product to us.

DIG A LITTLE DEEPER!

The word **geology** comes from Greek words. Find out what they are and their meaning.

There are many branches of geology, such as geochemistry, geophysics, and mineralogy. Do some research and find more branches of geology and find out what each branch studies.

If you were a geologist, what tools and equipment would you need? What qualifications do you need to become a geologist?

For a wonderful imaginary trip through the inside of the Earth read *How to Dig a Hole to the Other Side of the World* by Faith McNulty (Harper & Row, 1979).

Be a **ROCKHOUND!** Start collecting rocks and minerals. Identify your rocks by using reference books from the library. Maybe you can meet a geologist who will help you. Share your collection with the class.

Make a list of 10 rocks and minerals and, using a book from your school library, classify the rocks. Example: granite—igneous; limestone—sedimentary; marble—metamorphic.

Why can't we just find a mineral resource and use it as is instead of having to process it?

Choose one thing in your classroom or home that you like to use. Try to find what mineral resources it contains.

Find out more about the "Ages." Choose the Stone Age, Bronze Age, or Iron Age—and list at least five important facts about it.

Take a field trip through your neighborhood and record as many different uses of rocks and minerals as you can.

Some elements have strange sounding names. Look up molybdenum, vanadium, beryllium, selenium, and zirconium. What can you find out about each? In what products are they used?

COPPER—THE ANCIENT METAL

Man's first use of the Earth's natural resources was in the form of grasses, trees, animals and stone. Tools and weapons were made from wood, bone and stone. Flint was one of the stones first because it is a hard, dense mineral. It is one of the purists native forms of silica. A steel knife, today, is no sharper than an obsidian knife or spear point. Obsidian is a hard, glassy rock that is formed by volcanic eruptions.

Ancient people were our first "geologists" and "miners." They not only determined which rocks were best to use, but they learned how to make them into tools, hunting spears, arrows, fishhooks and ornaments. Shaping the stone was done by flaking it with sharp blows on the edges using another stone or deer antlers.

Stone-Age people knew nothing of metal. Colorful minerals were used for decoration or for barter. When emerald-green **malachite** (a copper ore) or a rusty-red **hematite** iron ore were found, they would be ground to a powder and used as pigments to decorate the face and body. They also used these and other colorful minerals pigments to paint the walls of caves and protected coves. Today, many minerals are used for paint pigments.

Can you imagine how excited these people were when they found native copper? It could be formed into decorative shapes and tools more easily by pounding it with a stone on a hard surface. This was after 6000 B.C. and is known as the *Copper Age*.

Both methods—flaking and pounding—were society's first forms of manufacturing. Therefore, Earth's resources were converted for man's use! The island of Cyprus, from which the word copper is derived, was a major source of copper for the Roman empire.

Over 4,000 years ago, when it was discovered that minerals could be melted, curiosity led man to combine melted metals (alloys). By accident they made bronze by adding tin to copper (the *Bronze Age*). Another combination of zinc and copper made brass. Both bronze and brass are stronger than pure copper. They do not corrode in air or water. Without these combinations of minerals and man's knowledge of mining and separating them, we would not have enough copper to take care of our needs today.

When copper tarnishes, it turns green to black on the surface. Some of the biggest deposits of copper were found by accident when prospectors noticed greenish rock sticking out of the ground (this is called an outcrop). Many of these discoveries were huge mountains of copper ore that also contained other important minerals.



Throughout the thousands of years since native copper was discovered, man has made great use of this element. Copper has a chemical symbol, as do all elements. It is Cu. Minerals are seldom found in a pure state. They are found bonded together with other minerals.

Copper is one of the most useful of the metals, and probably the one first used by man. It is found native and in a variety of combinations with other minerals. It is often a by-product from silver and other mining. Copper has many colors from yellowish-to-reddish brown, red, pink, blue, green, and black. The colors are determined by the other elements (minerals) combined with the copper.

Copper is malleable, ductile and long lasting. Copper conducts heat and electricity better than any other metal except silver. It has a wide use in electric and electronic equipment. It is used for tubing and pipes for plumbing and can be made into sheets for roofing. Copper also is used in chemical compounds. Copper chemicals are used in plant sprays and to treat swimming pools to keep algae from growing. Copper and its alloys are important for parts of automobiles, airplanes, missiles and satellites.

Recycling of copper has been ongoing for many, many years. It is collected as scrap metal and separated from other metals and materials by smelting and refining. Recycled copper is called secondary copper and it is used at brass mills and made into new things for our use.

Since ancient man and his use of flint and obsidian we have learned a lot about our Earth and its many resources.

Each day, scientists learn more about the mineral wealth locked in our planets crust. More is learned about new mineral wealth being born through volcanic activity. Earthquakes sometimes take away ore deposits. And at other times earthquakes bring new

mineral deposits closer to the Earth's surface.

Science and technology have shown us how to find, extract, process, and use mineral resources to the benefit of man. We are lucky to live in this time of history.

COPPER FACTS

Copper is a *native element*. The crystal system of native copper is cubic. It has a metallic luster and a specific gravity of 8-9 with a hardness of 2-1/2 to 3 and can be easily scratched with a knife. Native copper has no cleavage and its fracture is hackly. This element is heavy, ductile and malleable. Native copper is copper red on fresh fracture but may be greenish or bluish or tarnished if weathered. It is often found with small amounts of arsenic, antimony, bismuth, iron, and silver.

Copper Ores

Malachite (pronounced mala-kite) is usually a bright green color and has a nonmetallic luster. It has a light green streak and can always be scratched with a knife. Malachite, a copper carbonate, is an important ore of copper and is a good indicator of copper deposits. In its pure form it contains 57% copper, the rest is made up of carbonate and water.

Azurite also is a copper carbonate. It's streak is light blue. Malachite and azurite frequently occur together and are found in the upper weathered (oxidized) zones of copper ore bodies. Azurite is the scarcer of the two has a soft blue color.

Chalcopyrite is an iron-copper sulfide. It has a brass yellow color. It is distinguished from pyrite by being softer and yellower. Its golden glint when in small specks in quartz often is mistaken for gold. The glint will disappear when turned at certain angles to the light while gold appears the same at all angles. Chalcopyrite is the primary ore of copper and is prevalent wherever copper ore is being mined below the surface zone.

Chalcocite is a copper sulfide. It is one of the highest grade and most important ores of copper and is opaque with a dark lead gray to black color. Chalcocite is often associated with and shows alteration to azurite, bornite, covellite, malachite, and native copper. Important deposits are found in Arizona's Bagdad, Jerome, and Superior areas. Other localities include Bingham, Utah; Santa Rita, New Mexico; Ely, Nevada, and the Genesee Valley district in California.

Bornite is a copper-iron sulfide. Its color is a natural bronze, but on exposure it tarnishes to the variegated colors that have caused it to be nicknamed "Peacock ore." It is rarely found on the surface but is prevalent in deeper levels of copper mines.

Turquoise is a hydrous aluminum phosphate with

copper. To be desirable for gems the color should be green blue. The color is due to the presence of copper and is found near the surface of copper deposits. Sometimes it may appear as an outcrop.

Chrysocolla has various shades of blue to green and is a hydrous copper silicate. It is often found with azurite and malachite. Although its color is attractive, it is too soft to make good gem stones. Be aware of this fact when buying jewelry. Sometimes chrysocolla is passed off as turquoise.

The Sewing Machine—Its Story

Attempts to invent a sewing machine date as far back as 1775. But not until 1830 was a practical machine invented. Its inventor was Bathelemy Thimmonier of France. It made a "chain stitch" with a hooked needle and was built out of wood.

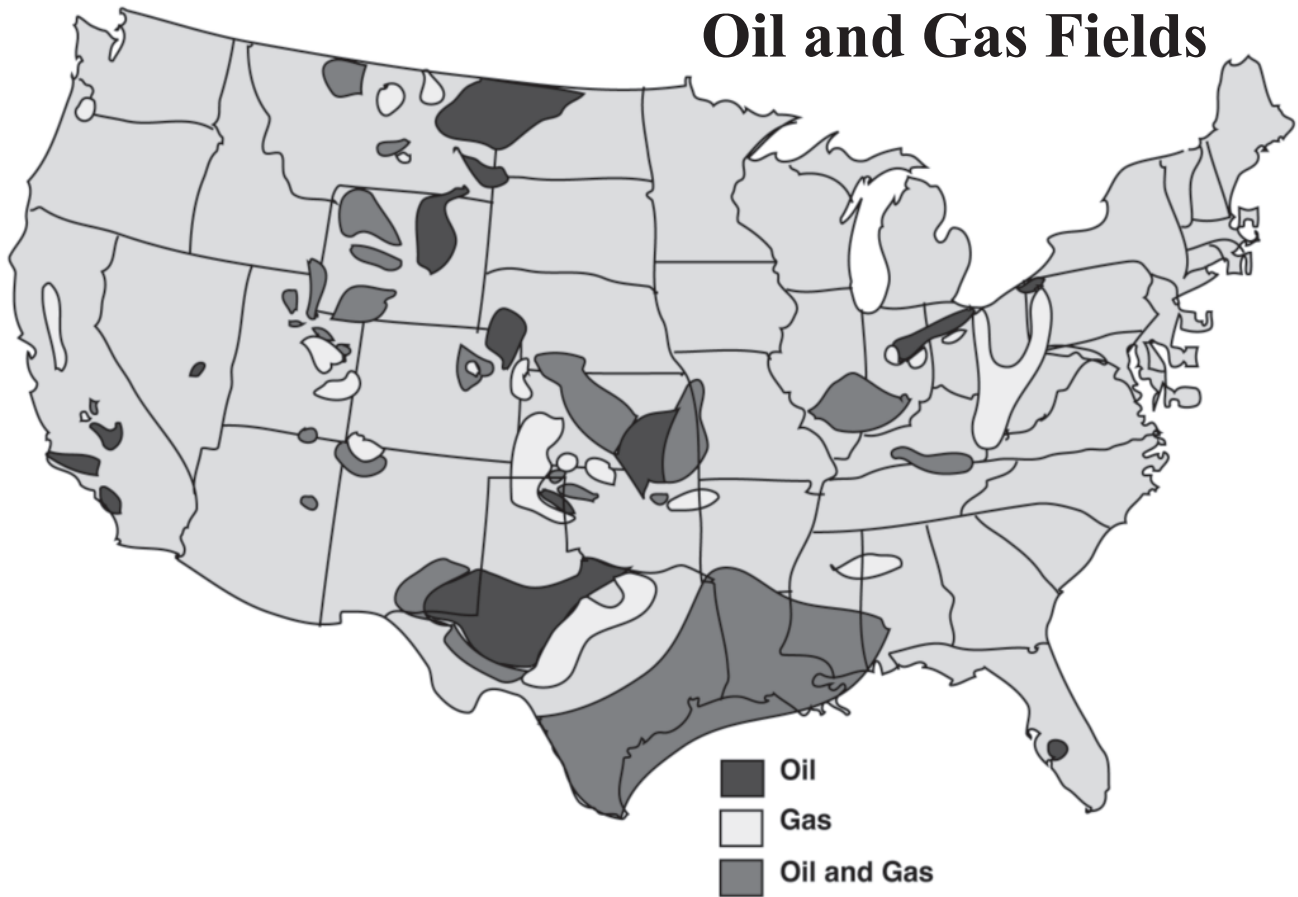
Around 1848, Elias Howe (an American) invented the "eye needle" which made a "lock stitch" and had a small shuttle that carried the thread through the loop made by the needle. An improved sewing machine was developed in 1850 with the invention of a round bobbin and hook by Allen Benjamin Wilson. Both machines were hand operated. **Isaac Singer** invented the foot treadle and a presser foot that kept the fabric in place.

Today, electricity has replaced the foot treadle. Sewing machines have motors. Motors are powered by electricity—which is another gift from **copper**!

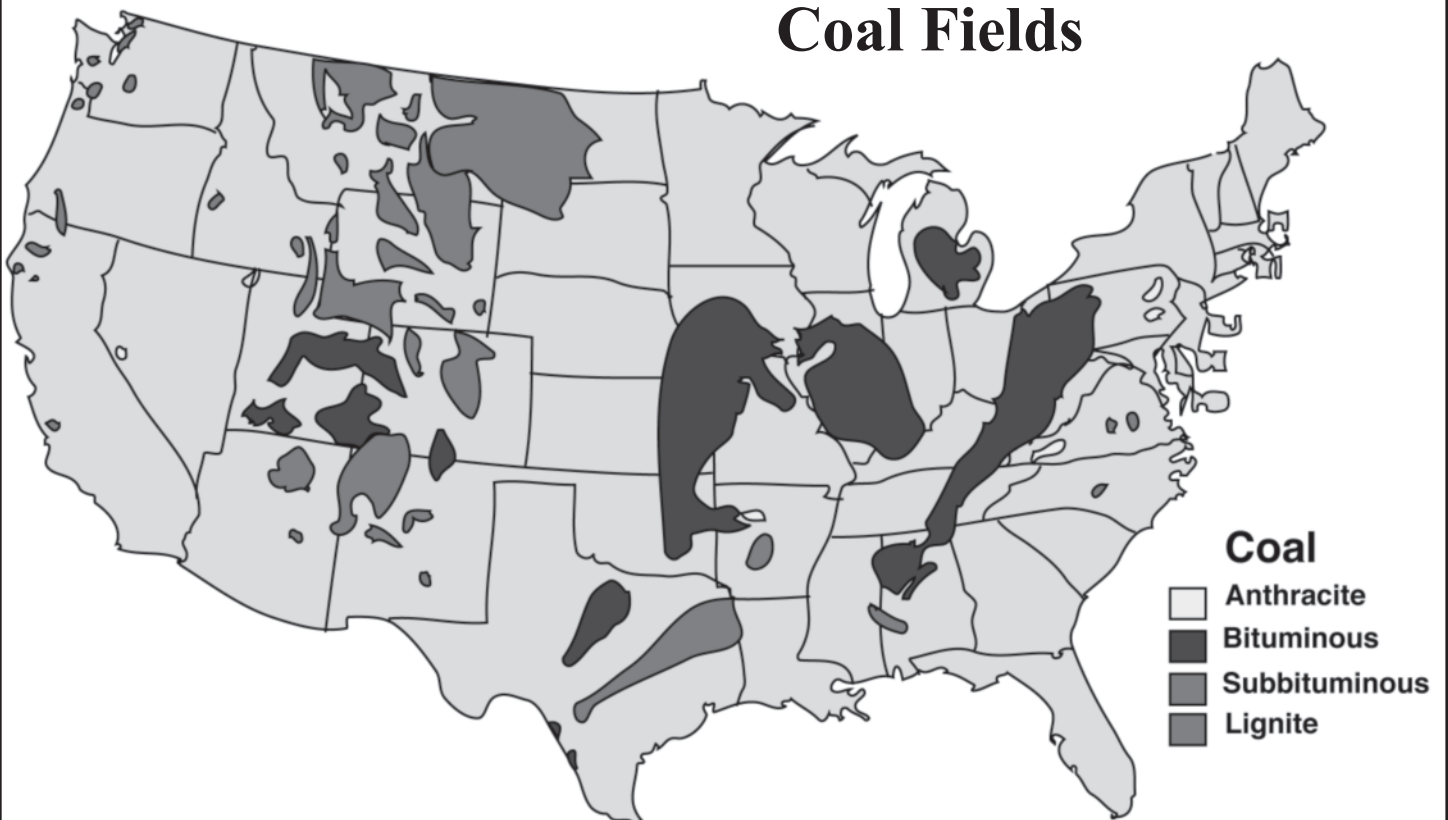
DIG A LITTLE DEEPER

- What other elements are classified as *native*?
- Take the new words you have learned today and put them in a list. Now, use them to make a Word Search. Try your word search on a classmate or someone at home.
- If there is copper or another mineral in your area, is it being mined? If so, write a letter to the mining company to find out if they give school tours. Maybe the company has a speaker who would come to your class to tell you more. Ask!
- If you look around your classroom or your home you will find many things in which copper is used. Some are hidden — like the wiring inside a wall that brings electricity into your home or school. How many other uses can you discover?

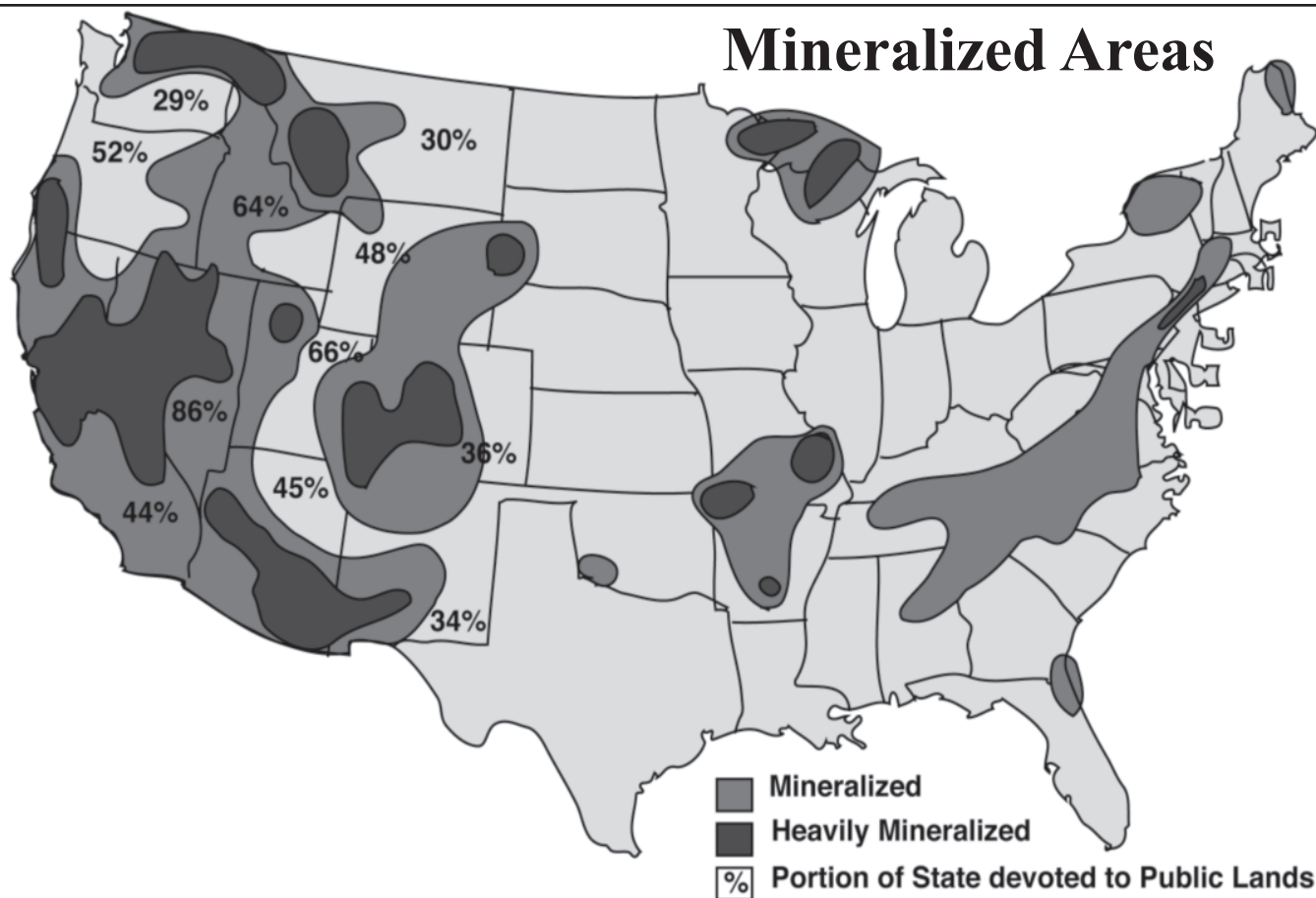
Oil and Gas Fields



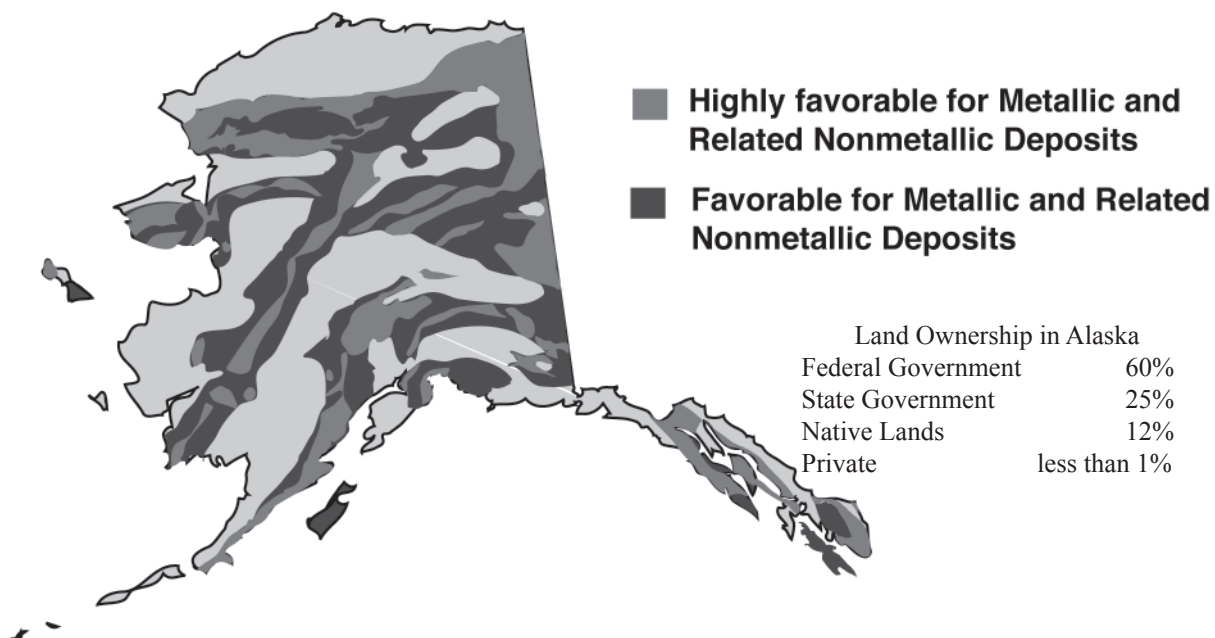
Coal Fields



Mineralized Areas



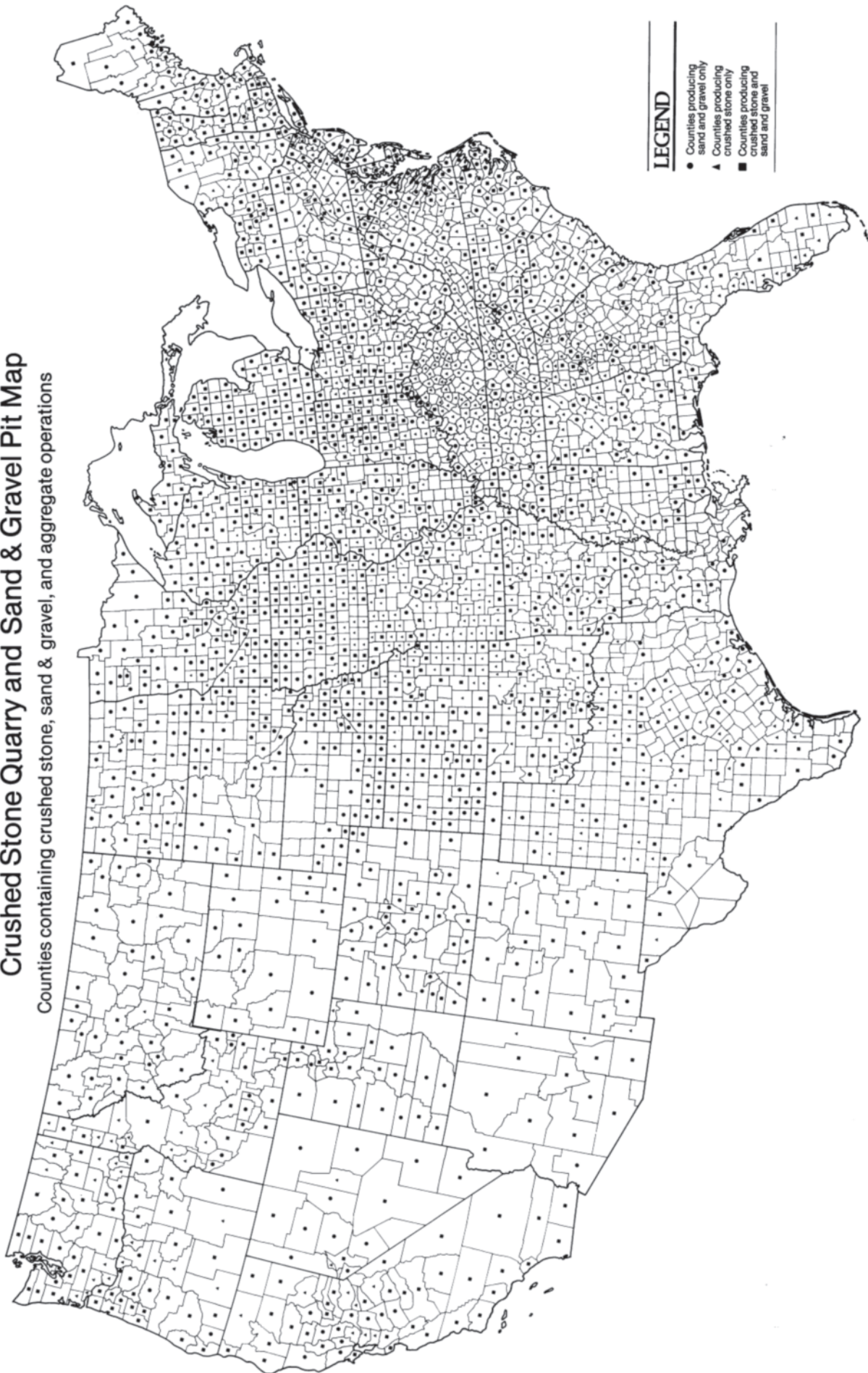
Alaska's Mineralized Zones



This Alaska map is to scale with the above map of the U.S.

Crushed Stone Quarry and Sand & Gravel Pit Map

Counties containing crushed stone, sand & gravel, and aggregate operations



LEGEND

- Counties producing sand and gravel only
- ▲ Counties producing crushed stone only
- Counties producing crushed stone and sand and gravel

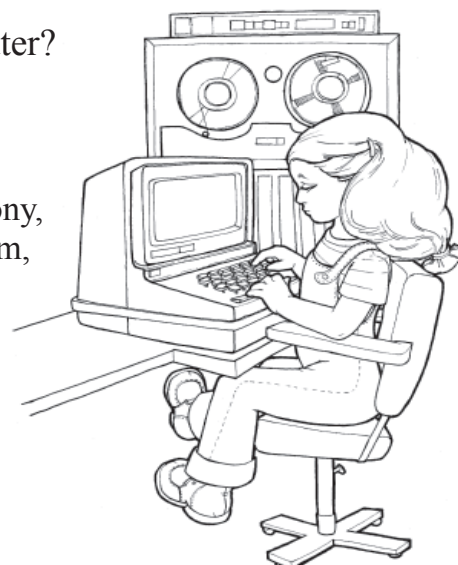
DID YOU KNOW

It takes more than 33 minerals and elements to make a computer?

List the minerals and elements used in computers and find out in which States they are found.

Those vital computer ingredients consist of: aluminum, antimony, barite, beryllium, cobalt, columbium, copper, gallium, germanium, gold, indium, iron, lanthanides, lithium, manganese, mercury, mica, molybdenum, nickel, platinum, quartz crystals, rhenium, selenium, silicon, silver, strontium, tantalum, tellurium, tin, tungsten, vanadium, yttrium, zinc, and zirconium.

And, we can't forget the petroleum industry's role in the computer. All the components are housed in plastic.



CONTACT your State Geologist for a list of publications, maps, and services available to help you.

Geologist: *One engaged in geologic study or investigations; one versed in geology.*

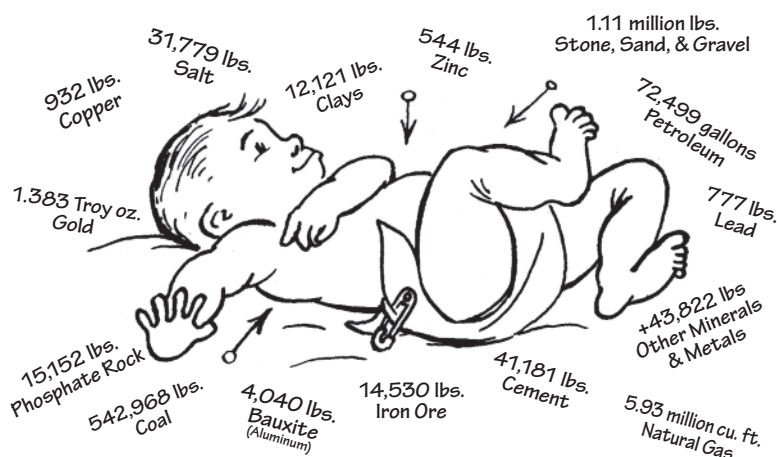
A geologist—

- studies the physical nature, structure and history of the Earth's crust;
- conducts research into the formation and dissolution of rock layers;
- analyzes fossil and mineral content of layers and endeavors to fix historical sequence of development by relating characteristics to known geologic influences;
- studies dynamic processes that bring about changes in the Earth's crust: great internal pressure and heat; volcanic eruptions; earthquakes; and air, water, and glacial erosion;

- studies seismic, gravitational, electrical, thermal, and magnetic phenomena to determine structure and composition of the Earth's surface;
- employs theoretical knowledge and research data to locate mineral, oil and gas deposits, and determines the probable area, slope, and accessibility of ore deposits; and
- prepares reports, maps and diagrams of regions explored.

Geologists love their profession because of the challenge of solving complex scientific problems. They especially enjoy the out-of-doors field work. Geologists also gain great satisfaction when their knowledge benefits humanity by finding resources, recognizing geologic hazards, or providing data for land-use decisions.

Every American Born Will Need...



2.9 million pounds of minerals, metals, and fuels in their lifetime

Aluminum: the most abundant metal element in the Earth's crust. Bauxite is the main source of aluminum. Aluminum is used in the United States in packaging (31%), transportation (22%), and building (19%). Guinea and Australia have 46 percent of the world's reserves. Other countries with major reserves include Brazil, Jamaica, and India.

Antimony: a native element; antimony metal is extracted from stibnite and other minerals. Antimony is used as a hardening alloy for lead, especially storage batteries and cable sheaths; also used in bearing metal; type metal; solder; collapsible tubes and foil; sheet and pipes; and, semiconductor technology.

Asbestos: because this group of silicate minerals can be readily separated into thin, strong fibers that are flexible, heat resistant, and chemically inert, asbestos minerals are suitable for use in fireproof fabrics, yarn, cloth, paper, paint filler, gaskets, roofing composition, reinforcing agent in rubber and plastics, brake linings, tiles, electrical and heat insulation, cement, and chemical filters.

Barium: used as a heavy additive in oil-well-drilling mud; in the paper and rubber industries; as a filler or extender in cloth, ink, and plastics products; in radiography ("barium milkshake"); as getter (scavenger) alloys in vacuum tubes; deoxidizer for copper; lubricant for anode rotors in X-ray tubes; sparkplug alloys. Also used to make an expensive white pigment.

Bauxite: a general term for a rock composed of hydrated aluminum oxides; it is the main ore of alumina to make aluminum; also used in the production of synthetic corundum and aluminous refractories.

Beryllium: used in the nuclear industry and in light, very strong alloys used in the aircraft industry. Beryllium salts are used in fluorescent lamps, in X-ray tubes and as a deoxidizer in bronze metallurgy. Beryl is the gem stones emerald and aquamarine.

Chromite: 99 percent of the world's chromite is found in South Africa and Zimbabwe. Chemical and metallurgical industries use 85% of the chromite consumed in the U.S.

Cobalt: used in superalloys for jet engines; chemicals (paint driers, catalysts, magnetic coatings); permanent magnets; and cemented carbides for cutting tools. Principal cobalt producing countries include Zaire, Zambia, Canada, Cuba, and the former Soviet Union. The United States uses about one-third of total world consumption. Cobalt resources in the U.S. are low grade and production from these deposits is not economically feasible.

Columbite-tantalite group (columbium is another name for niobium): the principal ore of niobium and tantalum, used mostly as an additive in steel making and in superalloys; used in metallurgy for heat-resistant alloys, rust-proofing (stainless steel), and electromagnetic superconductors. Brazil and Canada are the world's leading producers.

Copper: used in electric cables and wires, switches, plumbing, heating; roofing and building construction; chemical and pharmaceutical machinery; alloys (brass, bronze, and a new alloy with 3% beryllium that is particularly vibration resistant); alloy castings; electroplated protective coatings and undercoats for nickel, chromium, zinc, etc. The leading producer is Chile, followed by the U.S., the former Soviet Union, and Canada.

Feldspar: a rock-forming mineral; industrially important in glass and ceramic industries; pottery and enamelware; soaps; abrasives; bond for abrasive wheels; cements and concretes; insulating compositions; fertilizer; poultry grit; tarred roofing materials; and as a sizing (or filler) in textiles and paper.

Fluorite (fluorspar): used in production of hydrofluoric acid, which is used in the pottery, ceramics, optical, electroplating, and plastics industries; in the metallurgical treatment of bauxite, which is the ore of alumina; as a flux in open hearth steel furnaces and in metal smelting; in carbon electrodes; emery wheels; electric arc welders; toothpaste; and paint pigment.

Gold: used in dentistry and medicine; in jewelry and arts; in medallions and coins; in ingots as a store of value; for scientific and electronic instruments; as an electrolyte in the electroplating industry. South Africa has about half of the world's resources. Significant quantities are also present in the U.S., Australia, Brazil, Canada, China, and the former Soviet Union.

Gypsum: processed and used as pre-fabricated wallboard or as industrial or building plaster; used in cement manufacture; agriculture and other uses.

Halite (Sodium chloride—Salt): used in human and animal diet, food seasoning and food preservation; used to prepare sodium hydroxide, soda ash, caustic soda, hydrochloric acid, chlorine, metallic sodium; used in ceramic glazes; metallurgy; curing of hides; mineral waters; soap manufacture; home water softeners; highway deicing; photography; herbicide; fire extinguishing; nuclear reactors; mouthwash; medicine (heat exhaustion); in scientific equipment for optical parts.

Iron Ore: used to manufacture steels of various types. Powdered iron: used in metallurgy products; magnets; high-frequency cores; auto parts; catalyst. Radioactive iron (iron 59): in medicine; tracer element in biochemical and metallurgical research. Iron blue: in paints, printing inks; plastics; cosmetics (eye shadow); artist colors; laundry blue; paper dyeing; fertilizer ingredient; baked enamel finishes for autos and appliances; industrial finishes. Black iron oxide: as pigment; in polishing compounds; metallurgy; medicine; magnetic inks; in ferrites for electronics industry. Major producers of iron ore include Australia, Brazil, China, and the former Soviet Union.

Lead: used in lead batteries, gasoline additives and tanks, and solders, seals or bearings; used in electrical and electronic applications; TV tubes, TV glass, construction, communications, and protective coatings; in ballast or weights; ceramics or crystal glass; tubes or containers, type metal, foil or wire; X-ray and gamma radiation shielding; sound-proofing material in construction

industry; and ammunition. The U.S. is the world's largest producer and consumer of lead metal. Other major mine producers include Australia, Canada, and the former Soviet Union.

Lithium: lithium compounds are used in ceramics and glass; in primary aluminum production; in the manufacture of lubricants and greases; rocket propellants; vitamin A synthesis; silver solders; underwater buoyancy devices; batteries.

Manganese: essential to iron and steel production. The U.S., Japan, and Western Europe are all nearly deficient in economically minable manganese. South Africa and the former Soviet Union have over 70% of the world's reserves.

Mica: micas commonly occur as flakes, scales, or shreds. Sheet muscovite (white) mica is used in electronic insulators (mainly in vacuum tubes); ground mica in paint, as joint cement, as a dusting agent, in well-drilling muds; and in plastics, roofing, rubber, and welding rods.

Molybdenum: used in alloy steels (47% of all uses) to make automotive parts, construction equipment, gas transmission pipes; stainless steels (21%) used in water distribution systems, food handling equipment, chemical processing equipment, home, hospital, and laboratory requirements; tool steels (9%) bearings, dies, machining components; cast irons (7%) steel mill rolls, auto parts, crusher parts; super alloys (7%) in furnace parts, gas turbine parts, chemical processing equipment; chemicals and lubricants (8%) as catalysts, paint pigments, corrosion inhibitors, smoke and flame retardants, and as a lubricant. As a pure metal, molybdenum is used because of its high melting temperatures (4,730 °F.) as filament supports in light bulbs, metalworking dies and furnace parts. Major producing countries are Canada, Chile, and the U.S.

Nickel: vital as an alloy to stainless steel; plays key role in the chemical and aerospace industries. Leading producers include Australia, Canada, Norway and the former Soviet Union. Largest reserves are found in Cuba, New Caledonia, Canada, Indonesia, and the Philippines.

Perlite: expanded perlite is used in roof insulation boards; as fillers, filter aids, and for horticultural.

Platinum Group Metals (includes platinum, palladium, rhodium, iridium, osmium, and ruthenium): they are among the scarcest of the metallic elements. Platinum is used principally in catalysts for the control of automobile and industrial plant emissions; in catalysts to produce acids, organic chemicals, and pharmaceuticals. PGMs used in bushings for making glass fibers used in fiber-reinforced plastic and other advanced materials, in electrical contacts, in capacitors, in conductive and resistive films used in electronic circuits; in dental alloys used for making crowns and bridges; in jewelry. The former Soviet Union and South Africa have nearly all the world's reserves.

Potash: a carbonate of potassium; used as a fertilizer; in medicine; in the chemical industry; used to produce decorative color effects on brass, bronze, and nickel.

Pyrite: used in the manufacture of sulfur, sulfuric acid, and sulfur dioxide; pellets of pressed pyrite dust are used to recover iron, gold, copper, cobalt, nickel, etc.

Quartz (Silica): as a crystal, quartz is used as a semiprecious gem stone. Cryptocrystalline forms may also be gem stones: agate, jasper, onyx, carnelian, chalcedony, etc. Crystalline gem varieties include amethyst, citrine, rose quartz, smoky quartz, etc. Because of its piezoelectric properties quartz is used for pressure gauges, oscillators, resonators, and wave stabilizers; because of its ability to rotate the plane of polarization of light and its transparency in ultraviolet rays it is used in heat-ray lamps, prism, and spectrographic lenses. Used in the manufacture of glass, paints, abrasives, refractories, and precision instruments.

Rare Earth Elements: industrial consumption of rare earth ores is primarily in petroleum fluid cracking catalysts, metallurgical additives, ceramics and polishing compounds, permanent magnets, and phosphors. Rare earth elements are lanthanum, cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium, and lutetium.

Silica: used in manufacture of glass and refractory materials; ceramics; abrasives; water filtration; component of hydraulic cements; filler in cosmetics, pharmaceuticals, paper, insecticides; rubber reinforcing agent, especially for high adhesion to textiles; anti-caking agent in foods; flattening agent in paints; thermal insulator.

Silver: used in photography, chemistry, jewelry; in electronics because of its very high conductivity; as currency, generally in some form of an alloy; in lining vats and other equipment for chemical reaction vessels, water distillation, etc.; catalyst in manufacture of ethylene; mirrors; electric conductors; batteries; silver plating; table cutlery; dental, medical, and scientific equipment; electrical contacts; bearing metal; magnet windings; brazing alloys, solder. Silver is mined in 56 countries. Alaska and Nevada produce most of the U.S. silver. Largest silver reserves are found in Chile, Peru, Poland, Mexico and China.

Sodium Carbonate (Soda Ash or Trona): used in glass container manufacture; in fiberglass and specialty glass; also used in production of flat glass; in liquid detergents; in medicine; as a food additive; photography; cleaning and boiler compounds; pH control of water.

Stibnite (the main ore of Antimony): used for metal antifriction alloys, metal type, shot, batteries; in the manufacture of fireworks. Antimony salts are used in the rubber and textile industries, in medicine; and glass making.

Sulfur: used in the manufacture of sulfuric acid, fertilizers, chemicals, explosives, dyestuffs, petroleum refining; rubber; fungicides.

Tantalum: a refractory metal with unique electrical, chemical, and physical properties is used to produce electronic components; used for high-purity metals in products ranging from weapon systems to superconductors; capacitors; chemical equipment; dental and surgical instruments; rectifiers; vacuum tubes; furnace components; high-speed tools; catalyst; sutures and body implants; electronic circuitry; thin-film components. Used in optical glass and electroplating devices. There is no tantalum mined in the United States.

Titanium: a metal used mostly in jet engines, airframes, and space and missile applications; produced in the western and central U.S., the United Kingdom, China, Japan, and the former Soviet Union.

Tungsten: used in metalworking; construction and electrical machinery and equipment; in transportation equipment; as filament in light bulbs; as a carbide in drilling equipment; in heat and radiation shielding; textile dyes, enamels, paints, and for coloring glass. Major producers are China, Korea, and the former Soviet Union. Large reserves are also found in the U.S., Bolivia, Canada, and The Federal Republic of Germany.

Vanadium: used in metal alloys; important in the production of aerospace titanium alloys; as a catalyst for production of maleic anhydride

and sulfuric acid; in dyes and mordants; as target material for X-rays. The former Soviet Union and South Africa are the world's largest producers of vanadium. Large reserves are also found in the U.S. and China.

Zeolites: used in aquaculture (fish hatcheries for removing ammonia from the water); water softener; in catalysts; cat litter; odor control; and for removing radioactive ions from nuclear plant effluent.

Zinc: used as protective coating on steel, as die casting, as an alloying metal with copper to make brass, and as chemical compounds in rubber and paints; used as sheet zinc and for galvanizing iron; electroplating; metal spraying; automotive parts; electrical fuses; anodes; dry cell batteries; fungicides; nutrition

(essential growth element); chemicals; roof gutters; engravers' plates; cable wrappings; organ pipes; in pennies; as sacrificial anodes used to protect ship hulls from galvanic action; in catalysts; in fluxes; in phosphors; and in additives to lubricating oils and greases. Zinc oxide: in medicine, in paints, as an activator and accelerator in vulcanizing rubber; as an electrostatic and photoconductive agent in photocopying. Zinc dust: for primers, paints, sherardizing, precipitation of noble metals; removal of impurities from solution in zinc electrowinning. Zinc is mined in over 50 countries with Canada the leading producer, followed by the former Soviet Union, Australia, Peru, and China. In the U.S. mine production mostly comes from Tennessee, Missouri, New York and Alaska.

MAJOR MINERAL and ENERGY OCCURRENCES - UNITED STATES

There are known reserves of the following mineral materials in nearly every state: construction sand and gravel, crushed stone, a variety of industrial minerals, and gemstones.

Alabama: Asphalt (At); Bauxite (Al); Clay (Cl); Coal (C); Iron Ore (Fe); Limestone (Ls); Marble (Mr); Mica (Mi); Salt (Na); and, Petroleum (O).

Alaska: Beryl (Be); Coal (C); Copper (Cu); Gold (Au); Iron Ore (Fe); Mercury (Hg); Molybdenum (Mo); Natural Gas (G); Petroleum (O); Platinum (Pt); Tungsten (W); Uranium (U), and, Zinc (Zn).

Arizona: Asbestos (Ab); Copper (Cu); Gold (Au); Gypsum (Gp); Lead (Pb); Mercury (Hg); Molybdenum (Mo); Silver (Ag); Uranium (U); Vanadium (V); and, Zinc (Zn).

Arkansas: Barite (Ba); Bauxite (Al); Bromine (Br); Clay (Cl); Coal (C); Diamonds (D); Gypsum (Gp); Marble (Mr); Natural Gas (G); Petroleum (O); Soapstone (Sp), and, Zinc (Zn).

California: Asbestos (Ab); Borax (Bx); Bromine (Br); Clay (Cl); Copper (Cu); Gold (Au); Gypsum (Gp); Iron Ore (Fe); Lead (Pb); Lithium (Lt) Magnesium (Mg); Marble (Mr); Mercury (Hg); Molybdenum (Mo); Natural Gas (G); Petroleum (O); Platinum (Pt); Potash (K); Rare Earths (RE); Salt (Na); Silver (Ag); Talc (Tc); Tungsten (W); and, Zinc.

Colorado: Beryl (Be); Clay (Cl); Coal (C); Copper (Cu); Fluorspar (F); Gold (Au); Iron Ore (Fe); Lead (Pb); Marble (Mr); Mica (Mi); Molybdenum (Mo); Natural Gas (G); Petroleum (O); Silver (Ag); Tungsten (W); Uranium (U); Vanadium (V); and, Zinc (Zn).

Connecticut: Clay (Cl), Mica (Mi).

Delaware: Marl (Greensand) and Magnesium (Mg+) Compounds (from sea water).

Florida: Clay (Cl); Limestone (Ls); Peat (Pe); Phosphates (P); Titanium (Ti); and, Zirconium (Zr).

Georgia: Barite (Ba); Bauxite (Al); Clay (Cl); Gold (Au); Granite (Gn); Iron Ore (Fe); Manganese (Mn); Marble (Mr); Mica (Mi); Slate (Sl); Talc (Tc); and, Titanium (Ti).

Hawaii: Clay (Cl). Volcanic activity is building unknown mineral wealth at this time.

Idaho: Antimony (Sb); Cobalt (Co); Copper (Cu); Gold (Au); Iron Ore (Fe); Lead (Pb); Mercury (Hg); Phosphates (P); Silver (Ag); Thorium (Th); Titanium (Ti); Vanadium (V); Tungsten (W); and, Zinc (Zn).

Illinois: Clay (Cl); Coal (C); Fluorspar (F); Lead (Pb); Limestone (Ls); Petroleum (O); and Zinc (Zn).

Indiana: Clay (Cl); Coal (C); Gypsum (Gp); Limestone (Ls); Natural Gas (G); and, Petroleum (O).

Iowa: Clay (Cl); Coal (C); Gypsum (Gp); and, Limestone (Ls).

Kansas: Clay (Cl); Coal (C); Gypsum (Gp); Helium (He); Lead (Pb); Limestone (Ls); Natural Gas (G); Petroleum (O); Salt (Na); and, Zinc (Zn).

Kentucky: Clay (Cl); Coal (C); Fluorspar (F); Limestone (Ls); Natural Gas (G); and, Petroleum (O).

Louisiana: Gypsum (Gp); Natural Gas (G); Petroleum (O); Salt (Na), and, Sulfur (S).

Maine: Clay (Cl); and, Mica (Mi).

Maryland: Clay (Cl); Coal (C); Limestone (Ls); and, Natural Gas (G).

Massachusetts: Granite (Gn); and, Limestone (Ls).

Michigan: Bromine (Br); Clay (Cl); Copper (Cu); Gypsum (Gp); Iron Ore (Fe); Limestone (Ls); Natural Gas (G); Peat (Pe); Petroleum (O); Potash (K); and, Salt (Na).

Minnesota: Clay (Cl); Cobalt (Co); Copper (Cu); Granite (Gn); Iron Ore (Fe); Limestone (Ls); Manganese (Mn); and Nickel (Ni).

Mississippi: Clay (Cl); Iron Ore (Fe); Natural Gas (G); and, Petroleum (O).

Missouri: Barite (Ba); Clay (Cl); Coal (C); Copper (Cu); Iron Ore (Fe); Lead (Pb); Limestone (Ls); Marble (Mr); Natural Gas (G); Silver (Ag); and, Zinc (Zn).

Montana: Copper (Cu); Gold (Au); Graphite (Gr); Gypsum (Gp); Lead (Pb); Manganese (Mn); Natural Gas (G); Petroleum (O); Palladium (Pd); Phosphates (P); Platinum (Pt); Silver (Ag); Thorium (Th); Tungsten (W); Vermiculite; and, Zinc (Zn).

Nebraska: Clay (Cl); Natural Gas (G); and Petroleum (O).

Nevada: Barite (Ba); Clay (Cl); Copper (Cu); Gold (Au); Gypsum (Gp); Lead (Pb); Lithium (Lt); Magnesium (Mg); Mercury (Hg); Molybdenum (Mo); Petroleum (O); Salt (Na); Silver (Ag); Sulfur (S); Tungsten (W); and, Zinc (Zn).

New Hampshire: Beryl (Be); Granite (Gn); Mica (Mi); Thorium (Th).

New Jersey: Clay (Cl); Titanium (Ti); and, Zinc (Zn).

New Mexico: Coal (C); Copper (Cu); Gold (Au); Gypsum (Gp); Lead (Pb); Marble (Mr); Molybdenum (Mo); Natural Gas (G); Petroleum (O); Potash (K); Salt (Na); Silver (Ag); Uranium (U); Vanadium (V); and, Zinc (Zn).

New York: Clay (Cl); Emery (Em); Garnet (Gt); Gypsum (Gp); Iron Ore (Fe); Lead (Pb); Limestone (Ls); Natural Gas (G); Petroleum (O); Salt (Na); Sandstone (Ss); Silver (Ag); Slate (Sl); Talc (Tc); Titanium (Ti); and, Zinc (Zn).

Find Out

- How far the sand and gravel must be transported to make your sidewalks?
- How many miles of crushed stone must be transported to be used as road-fill for the road in front of where you live?
- How much more does it cost to make the sidewalks, driveways, and house foundations when the sand and gravel has to be transported greater distances? Investigate!

North Carolina: Asbestos (Ab); Clay (Cl); Copper (Cu); Gold (Au); Granite (Gn); Lithium (Lt); Marble (Mr); Mica (Mi); Phosphates (P); Talc (Tc); and, Tungsten (W).

North Dakota: Clay (Cl); Lignite (Lg); Natural Gas (G); Petroleum (O); Salt (Na); and, Uranium (U).

Ohio: Clay (Cl); Coal (C); Gypsum (Gp); Limestone (Ls); Natural Gas (G); Petroleum (O); Salt (Na); and, Sandstone (Ss).

Oklahoma: Coal (C); Copper (Cu); Gypsum (Gp); Helium (He); Lead (Pb); Limestone (Ls); Natural Gas (G); Petroleum (O); and, Zinc (Zn).

Oregon: Gold (Au); Mercury (Hg); Silver (Ag); and, Uranium (U).

Pennsylvania: Clay (Cl); Coal (C); Cobalt (Co); Iron Ore (Fe); Limestone (Ls); Natural Gas (G); Petroleum (O); Sandstone (Ss); Slate (Sl); and, Zinc (Zn).

Rhode Island: Sand and Gravel (SG) and Crushed Stone (CS)

South Carolina: Clay (Cl); and, Mica (Mi).

South Dakota: Beryl (Be); Gold (Au); Granite (Gn); Mica (Mi); Petroleum (O); Silver (Ag); Uranium (U); and, Vanadium (V).

Tennessee: Clay (Cl); Coal (C); Copper (Cu); Iron Ore (Fe); Limestone (Ls); Marble (Mr); Phosphates (P); Pyrites (S); Sandstone (Ss); and, Zinc (Zn).

Texas: Asphalt (At); Clay (Cl); Granite (Gn); Graphite (Gr); Gypsum (Gp); Helium (He); Iron Ore (Fe); Limestone (Ls); Natural Gas (G); Petroleum (O); Salt (Na); Silver (Ag); Sulfur (S); Talc (Tc); and, Uranium (U).

Utah: Asphalt (At); Beryllium (Be); Clay (Cl); Coal (C); Copper (Cu); Gallium (Ga); Germanium (Ge); Gold (Au); Gypsum (Gp); Iron Ore (Fe); Magnesium (Mg); Molybdenum (Mo); Natural Gas (G); Petroleum (O); Phosphates (P); Potash (K); Salt (Na); Silver (Ag); Uranium (U); and, Vanadium (V).

Vermont: Asbestos (Ab); Granite (Gn); Marble (Mr); Slate (Sl); and, Talc (Tc).

Virginia: Clay (Cl); Coal (C); Gypsum (Gp); Lead (Pb); Limestone (Ls); Slate (Sl); Soapstone (Sp); Titanium (Ti); and, Zinc (Zn).

Washington: Clay (Cl); Coal (C); Copper (Cu); Gold (Au); Gypsum (Gp); Lead (Pb); Magnesium (Mg); Marble (Mr); Silver (Ag); Talc (Tc); Uranium (U); Tungsten (W); and, Zinc (Zn).

West Virginia: Clay (Cl); Coal (C); Limestone (Ls); Natural Gas (G); Petroleum (O); and, Salt (Na).

Wisconsin: Copper (Cu); Iron Ore (Fe); Lead (Pb); Limestone (Ls); and, Zinc (Zn).

Wyoming: Clay (Cl); Coal (C); Diamonds (D); Iron Ore (Fe); Natural Gas (G); Petroleum (O); Phosphate (P); Uranium (U); and, Vanadium (V).

What's The Difference

mineral An inorganic substance occurring in nature, though not necessarily of inorganic origin, which has (1) a definite chemical composition or, more commonly a characteristic range of chemical composition, and (2) distinctive physical properties or molecular structure.

metal An opaque, lustrous, elemental, chemical substance that is a good conductor of heat and electricity and, when polished, a good reflector of light.

industrial mineral Rocks and minerals not produced as sources of the metals but excluding mineral fuels.

Suggested Activities

Can you and your class identify other mineral resources found in your state?

With this listing, identify the minerals that are scarce within the geographical boundaries of the United States. Use a map to plot your findings.

Plot on a map the states that have mineral resources like those found in your state.

Does your state have wind power? Solar power? Geothermal power? Hydropower? Coal-fired plants?

FROM: ISOP External Affairs

CLASSIFIED AND CONFIDENTIAL

Page 1 of 2

CLEARANCE AA REQUIRED

Project Vadar

TO: Routing Below

Government Document

For Your Eyes Only

Ref. 1 ebd 3977-64F

ROUTING

White House UN Security
Pentagon National Palace
Prime Minister NASA-Cape Canaveral
NASA-Houston Project Team
Acknowledge Receipt _____

AA Clearance Document :
Divulging this information
is illegal and considered
treasonous, punishment as
NAA Class 1 Offense.

TOP SECRET

On February 4, astronomers at Kitt Peak Observatory in Arizona accidentally sighted a giant comet about to enter our solar system. The comet was observed and its position carefully plotted over a period of two months. Initial calculations indicated that the comet would pass very, very close to Earth and, in fact, with the estimated experimental errors, a collision with Earth was deemed highly possible. Because of this possibility and because of the apparent size of the comet, North American government officials have declared a **consolidated national emergency** (Priority A-1). Public disclosure is being deferred until a later date.

The gravity of the situation was considered to be sufficient for the North American Alliance governments to provide priority funding for a study of the comet. That study was completed last week. The report states: "We have firmly established that Comet Vadar is on a collision course with Earth. We have also firmly established that the mass and velocity of Vadar are sufficiently large to cause the collision to be fatal. The collision will change the Earth's axis of rotation by more than 2 degrees. At a minimum, this will result in massive tidal waves, extremely high velocity winds and abrupt and severe weather changes. The effect on orbit is unknown. Collision will occur 227 days from today's date."

The decision has been made not to inform the peoples of the world of these facts until a well thought out program has been established. (Outstanding psychologists, psychiatrists, members of the clergy, scientists, sociologists, government officials and selected U.N. representatives will draw up the plan.)

In the meantime, the governments of the North American Alliance have decided to undertake a project to colonize Mars. Mars was selected in that it is the closest object now known that can, with some ingenuity, support life as we know it. It was also decided that because of the psychological barriers involved in such a project, both a team of scientists and a team of lay people would be engaged to work on the project. You are gathered here today because you have been selected as members of the lay person team. If you choose to accept that assignment, you are to begin immediately on the first item—the selection of materials and participants for the mission. The world's combined availability of space craft will limit you to sending 10 rockets with two passengers and a payload of 100,000 pounds each.

It has tentatively been determined that the first launching will begin in approximately eight months. All ten rockets are to be launched in a period of time not to exceed one month. Public announcement of the exact nature of this project and of the Earth's situation will be made no less than two weeks after the last rocket is launched and no more than 2 months before Vadar strikes Earth.

Today you are to make preliminary decisions on two critical questions. You will then meet with the scientists and finalize the selections. Final decisions are to be made in two weeks. The NASA ecosystem analysis (attached to this document) will help you in these decisions.

Of utmost importance is the need to establish a sustainable, permanent colony. There is no return and opportunities for resupply appear unlikely.

Project Vadar:
A Voyage To Mars

CLASSIFIED AND CONFIDENTIAL
CLEARANCE AA REQUIRED
Government Document
Ref. 1 ebd 3977-64F

Page 2 of 2

ROUTING
White House UN Security
Pentagon National Palace
Prime Minister NASA-Cape Canaveral
NASA-Houston Project Team
Acknowledgment of Receipt

AA Clearance Document:
Divulging this information
is illegal and considered
treasonous, punishment as
NAA Class 1 Offense.

CONFIDENTIAL

Decision Document

- What are the names or skills of the 20 people who will make the trip with you?
- What are the ten most important items you will need to bring life from Earth to Mars, and to sustain that life?

Characteristic:	Earth	Mars
EQUATORIAL DIAMETER (EARTH = 1 OR 7,926.4 MILES)	1	0.53
MASS (EARTH = 1)	1	0.11
VOLUME (EARTH = 1)	1	0.15
DENSITY (WATER = 1)	5.52	3.95
EQUATORIAL SURFACE GRAVITY (EARTH = 1)	1	0.38
ROTATION ON AXIS (EARTH = 1 day)	1 day	1.03 days
REVOLUTION AROUND SUN (EARTH TIME)	1 year	1.88 years
WATER COVER	71%	No liquid water, but polar ice caps and appears to have ground water.
ATMOSPHERE	78% = N ₂ , 21% = O ₂ 1% = CO ₂ , A & others	95% = CO ₂ , 3% = N ₂ >1% O ₂
MAGNETIC FIELD	Yes	Weak
LAND SURFACE	Chiefly Silicates	A typical weathered volcanic soil.
TEMPERATURE	moderate variations min. = -127° F max. = 136° F	At the equator: mostly below zero min. = -150° F max. = 80° F
LIFE	Abundant, many forms, heavily depending on liquid water, and in most cases, oxygen.	Little protection against the sun's radiations that UV would quickly kill any unprotected Earth organisms.
SOLAR INPUT (at surface)	$\cong 1000 \frac{\text{watts}}{\text{m}^2}$	$\cong 500 \frac{\text{watts}}{\text{m}^2}$

From a copyrighted activity of Kendall/Hunt Publishing Company, *Global Science: Energy, Resources, Environment*

Per Capita Mineral Usage

Every year— 37,687 pounds of new minerals must be provided for every person in the United States to make the things we use every day



8,343 lbs. **Stone** used to make roads, buildings, bridges, landscaping, and for numerous chemical and construction uses



5,937 lbs. **Sand & Gravel** used to make concrete, asphalt, roads, blocks & bricks



530 lbs. **Cement** used to make roads, sidewalks, bridges, buildings, schools and houses



187 lbs. **Iron Ore** used to make steel— buildings; cars, trucks, planes & trains; other construction; containers



409 lbs. **Salt** used in various chemicals; highway deicing; food & agriculture



195 lbs. **Phosphate Rock** used to make fertilizers to grow food; and as animal feed supplements



156 lbs. **Clays** used to make floor & wall tile; dinnerware; kitty litter; bricks & cement; paper



52 lbs. **Aluminum (Bauxite)** used to make buildings, beverage containers, autos, and airplanes



12 lbs. **Copper** used in buildings; electrical & electronic parts; plumbing; transportation



10 lbs. **Lead** 75% used for transportation— batteries, electrical, communications and TV screens



7 lbs. **Zinc** used to make metals rust resistant, various metals & alloys, paint, rubber, skin creams, health care and nutrition



44 lbs. **Soda Ash** used to make all kinds of glass; in powdered detergents; medicines; as a food additive; photography; water treatment



3 lbs. **Manganese** used to make almost all steels for construction, machinery and transportation



403 lbs. **Other Nonmetals** have numerous uses: glass, chemicals, soaps, paper, computers, cell phones



19 lbs. **Other Metals** have the same uses as nonmetals but also electronics, TV & video equipment, recreation equipment, and more

Plus These Energy Fuels

• 933 gallons of **Petroleum** • 6,988 lbs. of **Coal** • 76,319 cu. ft. of **Natural Gas** • 1/4 lb. of **Uranium**

To generate the energy each person uses in one year—
equivalent to 300 people working around the clock for each of us.



What's the difference between today and 200 years ago?

To maintain our standard of living requires the continual production of raw materials.

Those materials provide our food, our homes, schools, hospitals, and factories, and the equipment and energy to make them operate.

In 1776, when America became independent, people's needs were more simple, requiring fewer natural resources. Most people never travelled more than 20 miles from their birthplace in their entire lifetime.

Think about your life style today compared with living more than 200 years ago. List things that are different.

Pounds of minerals and metals used every year by the average American

	1776	2010
Aluminum (bauxite)	0	52
Cement	12	530
Clay	100	156
Coal	40	6,988
Copper	1	12
Iron Ore	20	187
Lead	2	10
Phosphate	0	195
Potash	1	22
Salt	4	409
Sand, gravel & stone	1,000	14,280
Sulfur	1	73
Zinc	0.5	7
All Others	18.8	14,766
Total pounds/capita/year	1,200	37,687

Sources: USGS, Nat'l Mining Assoc., Energy Information Admin., US Census

AIR



FOOD



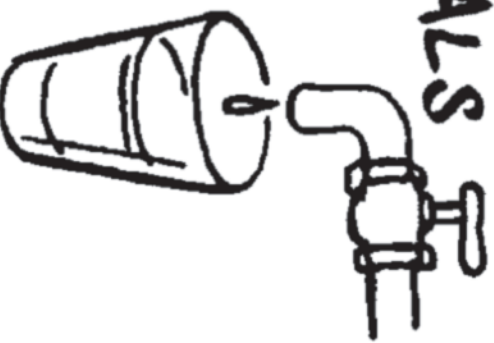
SOIL

FORESTS



PLANTS

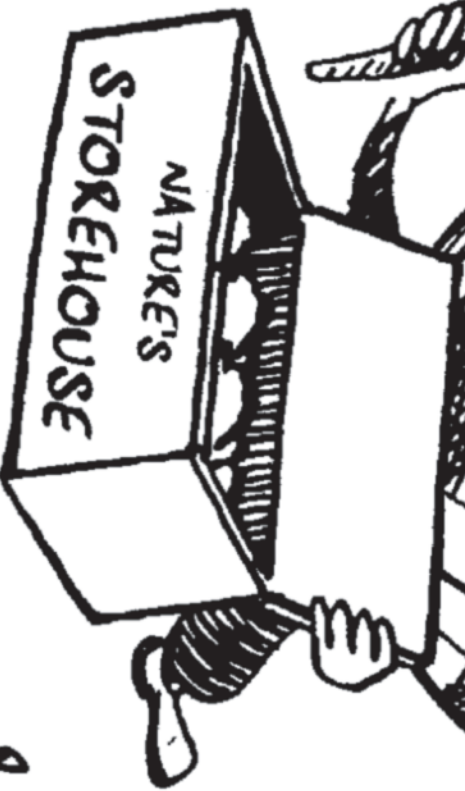
ANIMALS



WATER



PETROLEUM



NATURE'S
STOREHOUSE

ROCKS
MINERALS

